INTERTIDAL AND SHALLOW WATER HYDROIDS FROM FIJI. I. ATHECATA TO SERTULARIIDAE

M.J. Gibbons and J.S. Ryland

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Athecate and thecate hydroids, other than hydrocorallines, were collected intertidally and from shallow water around Viti Levu and its nearby islands, Fiji, 1978–1980. The habitats are described. The collected material, other than Plumulariidae (*senso lato*), is referred to 40 species, which are described and illustrated. *Clytia edentula* and *Sertularia orthogonalis* are described as species novae. Some of the remaining species were already known to be widely distributed in the Indo-Pacific, but rarely recorded species include *Halecium sibogae* Billard, *Hydrodendron gardineri* (Jarvis) and *Diphasia orientalis* Billard. The history and status of the generic names *Pennaria* Oken, *Pennaria* Goldfuss and *Halocordyle* Allman are discussed in relation to the 'International Code of Zoological Nomenclature'. It is established that, since *Pennaria* Oken was disallowed by the International Commission on Zoological Nomenclature in 1956, *Pennaria* Goldfuss represents a valid introduction and *Halocordyle* becomes its junior subjective synonym. *Sertularia borneensis* Billard is retained and not regarded as conspecific with *S. turbinata* (Lamouroux) but *Thyroscyphus vitiensis* Marktanner-Turneretscher is referred to *T. fruticosus* (Esper).

☐*Hydroida, taxonomy, Pacific, Fiji, coral reefs, intertidal, shallow water.*

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Hydroids were collected from intertidal and shallow-water reefal habitats around Fiji during the period 1978–80. Forty species (excluding Plumulariidae *sensu lato*, which will be described in a second paper) have been recognized. There has been no previous account of Fijian hydroids. Unfortunately, and contrary to the situation for certain temperate areas, there is no monograph covering the Hydroida of the tropical Indo-West Pacific, although a number of expedition reports and accounts of collections from specific regions or island groups have been published, e.g., the voyages of the *Uranie* (Lamouroux, 1824), *Challenger* (Allman, 1883, 1888) and *Siboga* (Billard, 1913, 1925), and covering the Red Sea (Vervoort, 1967; Schmidt, 1972; Hirohito, 1977), western Indian Ocean (Rees and Vervoort, 1987), East Africa (Millard and Bouillon, 1974; Millard, 1975), Madagascar (Billard, 1907; Gravier, 1970), Seychelles (Jarvis, 1922; Millard and Bouillon, 1973, 1975), southern India (Mammen, 1963, 1965, 1967), eastern Indian Ocean (Ritchie, 1910a, b), Great Barrier Reef-Papua New Guinea (Bale, 1884; Kirkpatrick, 1890; Briggs and Gardiner, 1931; Pennycuik, 1959; several papers by Bouillon, e.g. 1984, mostly on medusae); Bonin Islands-Kyushu, Japan (Jäderholm, 1919; Stechow, 1909, 1913; Hirohito, 1969, 1974), Micronesia (Cooke, 1975), French Polynesia (Vervoort and Vasseur, 1977) and Hawaii (Cooke, 1977). There are also a few papers dealing with Pacific Ocean hydroids generally or with museum holdings that contain specimens from Pacific locations. The papers of Vervoort and Vasseur (1977) and Rees and Vervoort (1987) contain extensive regional bibliographies. The general paucity of information on Melanesia-Micronesia-Polynesia is striking.

The identification of tropical Indo-Pacific hydroids in situ presents enormous problems. It is difficult enough studying them in a European provincial institution that lacks nineteenth century literature and extensive reference collections. We have been largely dependent on both the library and the collections of the British Museum (Natural History). Pennycuik's (1959) paper on Queensland hydroids illustrates the point. Her paper provides a valuable compendium of the species present but is almost useless for identification without a backup library. On the other hand, the good descriptive works of Billard (1913, 1925), Vervoort and Vasseur (1977) and Rees and Vervoort (1987) are either incomplete or describe a fauna patently less diverse than that of Fiji. Our compromise is to suggest the use of Millard's (1975) comprehensive *Hydroida of Southern*

Africa, which is modern, widely available, and fully keyed to families and genera (whether indigenous to South Africa or not), as a base text. We have provided descriptions and illustrations of the Fijian species.

A short background introduction to the coral reefs of Fiji has been given by Ryland (1981), amplified subsequently by sections relating to particular reefs (Ryland, 1982; Ryland, Wigley and Muirhead, 1984; Dilly and Ryland, 1985). Morton and Raj (1980) described some reefs and other intertidal habitats in a University of the South Pacific teaching manual, while Penn (1983) has given an invaluable account of the hydrographic conditions affecting reefs in the vicinity of Suva. A summary of knowledge on Fijian reefs has recently been prepared by Wells (1989).

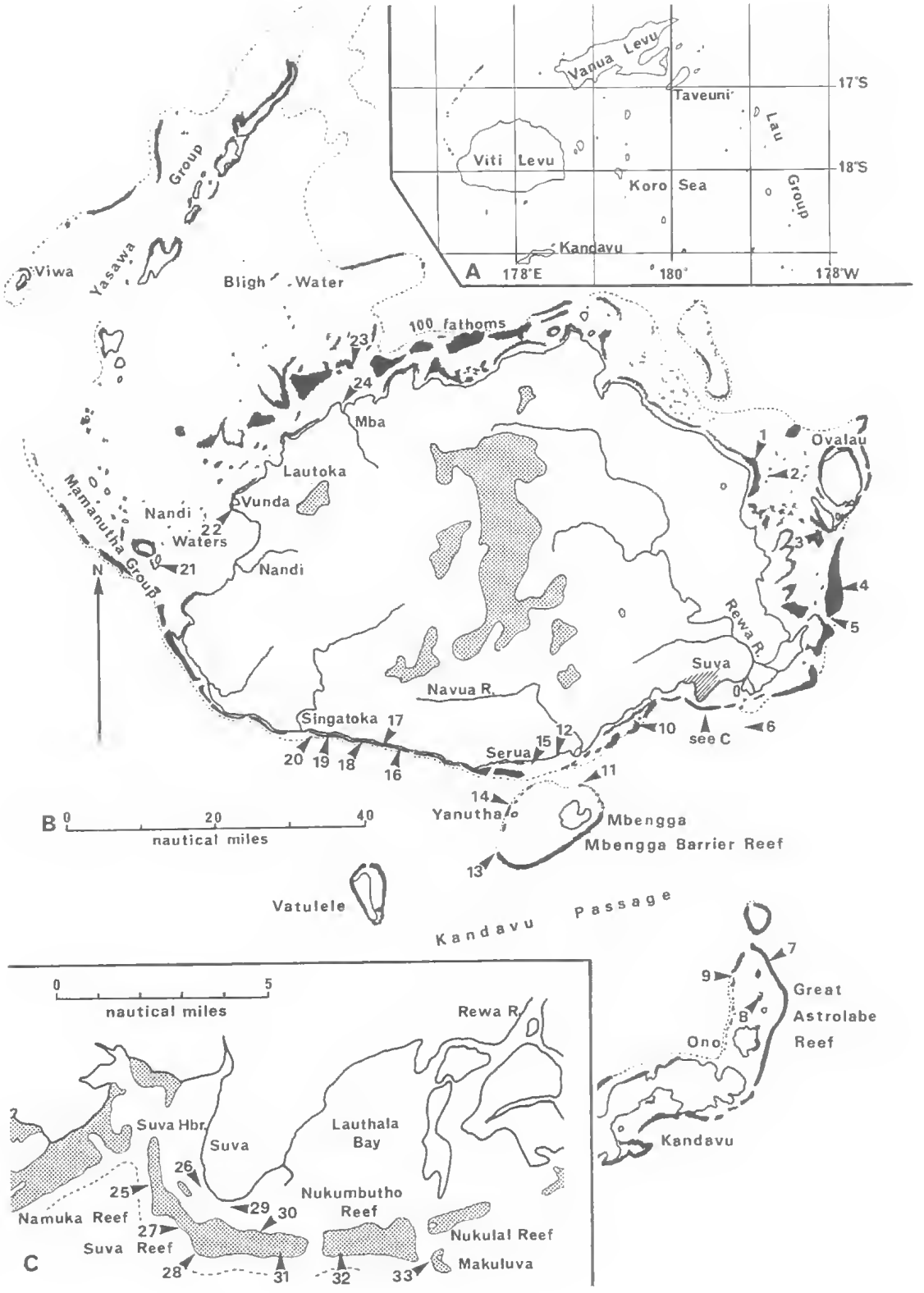
The Fiji archipelago comprises some 360 islands (Derrick, 1957), the main ones being Viti Levu, Vanua Levu, Taveuni and Kandavu (Fig. 1) disposed from northeast to south in a westerly convex crescent. East of this arc, over the relatively shallow (<3,000 m) Fiji Plateau, lie the many smaller islands of the Lomaiviti and Lau groups extending towards Tonga. Westward of Viti Levu the relative shallows extend as far as the Vanuatu (New Hebrides) island arc. Abyssal depths lie between Fiji and Tuvalu (Ellice Islands) to the north and between Fiji and New Zealand to the south; ocean trenches to the west (Vanuatu) and east (Tonga) delimit the Fiji Plateau. The Fiji islands are wholly tropical (15°30' — 20°30'S) and straddle the 180° meridian. Warm surface water, derived from the South Equatorial Current, flows southwestwards through the group. The hot season maximum sea surface temperature is about 30°C in February-March and the cool season minimum about 24°C in August.

The larger, volcanic islands are surrounded by fringing and/or barrier reefs (depending on the width of their insular shelf), while many of the smaller islands are coral formations (Ladd, 1934). There are no true atolls. The collections have been made mainly around Viti Levu or from the Great Astrolabe Reef northeast of Kandavu. In southwest Viti Levu, in the absence of insular shelf, the shore ('Coral Coast') is lined with fringing reef (Ryland, 1982; Ryland *et al.*, 1984); elsewhere the major reefs lie more or less offshore. The Great Sea Reef, extending for nearly 300 nautical miles (off the area covered by Fig. 1B) delimits the shelf to the north of Vanua Levu and Viti Levu. Northwest of Viti Levu the Great Sea Reef merges into the islands of the Yasawa and Mamanutha chains, from the southern end of which ribbon reef approaches the shore and continues as the fringing reef of the Coral Coast. The Great Astrolabe Reef is quite separate from this system (Fig. 1B).

Fiji lies in the belt of southeast tradewinds which blow most strongly and persistently from July to December. Thus reefs off Suva and along the south coast are windward reefs, while conditions in Nandi and Bligh Waters are relatively sheltered. Since Viti Levu is high, the southeast is subjected to heavy precipitation (>3,000 mm annually) while the rest of the island is drier and sunnier. The centre and east drain mainly through the tributaries of the Rewa, the outflow from which profoundly affects coastal ecosystems in the Suva area. The Rewa catchment covers 3920 km^2 of the wettest part of Viti Levu (Derrick, 1957) and has a mean outflow of about 13.5 x 10^6 m^3 day^{-1} (L. Harris, *pers. comm.*) but reached an estimated peak of 777.6 x 10^6 m^3 day^{-1} following a cyclone in April, 1980 (Harris, 1980). Smaller rivers include the Navua (3.9 x 10^6 m^3 day^{-1}) and Singatoka (3.8 x 10^6 m^3 day^{-1}) in the south and the Mba (2.3 x 10^6 m^3 day^{-1}) in the northwest. Fresh water from the Navua in the 1980 flood (estimated peak discharge 522.7 x 10^6 m^3 day^{-1}: Harris, 1980) certainly killed all visible coral at the accessible Ndeumba reef, though effects on the less conspicuous animals are unknown to us.

Most collecting was conducted on the reefs near Suva, for which also the best environmental data are available. Neap tides have a mean range of 0.9 m and springs 1.30 m. Tidal cycles occur approximately twice daily but the two tides often differ

FIG. 1. Location map. A. The Fiji archipelago; B. Viti Levu and eastern Kandavu; land over 2000 ft (610 m) stippled, reefs black; C. Suva Harbour and Lauthala Bay; reefs stippled. Locations: 1, Tailevu Point, fringing reef; 2, Nukulevu; 3, Thangilai; 4, Mambualau; 5, Tomberua Pass; 6, deep water (1000 m) site off Makuluva; 7, Great Astrolabe reef, NE of Ndravuni; 8, Yaukuve Levu, fringing reef; 9, Herald Pass; 10, Joske's reef, Namuka, 11, Pratt Reef, north of Mbengga; 12, Fringing reef at E end of Taunovo Bay, Ndeumba; 13, Frigate Pass, Mbengga lagoon; 14, N. end of Yanutha reef; 15, Ngaloa; 16-20, the 'coral coast', fringing reefs: Vorualailai, Tangangge, Namanda, Malevu, Korotongo; 21, Malolo Lailai; 22, Vunda Point fringing reef; 23, Yarawa reef; 24, Sand flats, mouth of Mba river; 25, Suva harbour fore-reef; 26, Nasese; 27, Nasese fore-reef; 28; Suva Point fore-reef; 29, Suva Point sand flats; 30, University back-reef; 31, University reef, seaward fringe; 32, Nukumbutho reef, seaward fringe; 33, Makuluva Pass. (For descriptions of localities see text).


Vanua Levu
Taveuni
Lau Group
Viti Levu
Koro Sea
Kandavu
17°S
18°S
178°E
180°
178°W
A
Viwa
Yasawa Group
Bligh Water
100 fathoms
Mba
Lautoka
Vunda
Nandi
Waters
Mamanutha Group
Nandi
N
Ovalau
Rewa R.
Suva
Navua R.
Singatoka
Serua
see C
Yanutha
Mbengga
Mbengga Barrier Reef
Vatulele
Kandavu Passage
B
0 20 40
nautical miles
0 5
nautical miles
Rewa R.
Suva Hbr.
Suva
Lauthala Bay
Namuka Reef
Suva Reef
Nukumbutho Reef
Nukulal Reef
Makuluva
C
Great Astrolabe Reef
Ono
Kandavu

in amplitude. Fortuitously, the lower low tide during springs is diurnal during the cooler months but nocturnal during the hot season; moreover, hot season tides are of smaller amplitude. Penn (1983) has calculated that the reef flat off Suva is emersed by day for 65 out of 88 tides in the three winter months June, July and August but on only 36 occasions in the summer months December, January and February. Further, whereas 30 of the winter emersions in 1979 were associated with predicted lows <0.35 m, in summer 1979–80 no ebbs <0.4 m were predicted. Thus during the hottest, wettest season emersion is usually both infrequent and brief.

Penn's (1983) study also revealed that water flow over the reef is unidirectional and incursive, while outflow from the backreef lagoon proceeds through passes (Fig. 1C). Not only does sessile fauna benefit directly during immersion from the continuous inflow of ocean water over the reef, but the strength and direction of flow prevent any low salinity surface layer of lagoonal water (as whenever the Rewa is in spate) reaching the fore-reef edge where hydroids and other fauna become plentiful. Three visits to the Great Astrolabe Reef leave a strong impression that the same pattern of circulation obtains.

Collections were made at low tide on the fronts of many reefs. Coral boulders on the outer flat of the Suva reefs were turned and examined for hydroids and other sessile fauna (Dilly and Ryland, 1985). Little occurred on boulders away from the reef edge except *Dynamena crisioides*, but large colonies of *Thyroscyphus fruticosus* grew upright through sand, and a few small species such as *Clytia hemisphaerica* and *Obelia bidentata* occurred on sea grass (*Halodule pinifolia* (Miki) den Hartog) or fine red algae (*Gracilaria* sp.) over backreef sand flats at Suva and Mba. The tops of surge grooves, and the sides of drainage channels, cavities and blow holes, were inspected from above or by snorkelling, the hydroids being picked off or collected from dead coral by hammer and chisel. Such algae as characterized the reef edge (*Turbinaria ornata* (Turner) J. Ag., *Sargassum cristaefolium* C. Ag. and various tufted, corallinaceous reds) seemed rarely to support hydroids but a restricted patch of a red alga, probably *Laurencia*, at Ndeumba yielded several, mainly sertulariid, species.

On part of the windward Great Astrolabe Reef, sandy surge channels transect the reef and it is possible to swim between irregular banks of coral and other hermatypes. Hydroids were collected from the prolific growths around the bases of large coral heads. The planar fans of *Gymnangium hians* and *Lytocarpia brevirostris* were clearly orientated across the direction of current flow. By contrast, because of either the relative lack of current or the warming of the shallow water (to 35°C in summer), the analogous niches in the drainage channels on the permanently immersed flat of the Coral Coast fringing reefs (Ryland, 1981, 1982; Ryland *et al.*, 1984) were devoid of hydroids.

A number of collections were made by colleagues using SCUBA in reef passes or on the reef fronts. The larger hydroids in all habitats commonly supported smaller species such as *Hebella scandens, H. dyssymetra* and *H. parasitica*. Finally, one deep water species of *Lytocarpia* was obtained fortuitously entangled in a prawn trap.

Hydrocorallines (Milleporidae, Stylasteridae) have been excluded from this paper. However, three species of *Millepora* were known to be present at the time of Boschma's (1948) review of the genus: *M. exaesa* Forsskål, noted by us at Makuluva, *M. platyphylla* Hemprich and Ehrenberg in Ehrenberg, and *M. tenera* Boschma, recorded earlier as *M. tortuosa* by Dana (1848) or *M. tenella* Ortmann. The last two were recorded again from the Suva reefs by Boschma (1950) and can be noted here as being abundant on the windward reefs visited. Three nominal species of *Distichopora* were listed from Fiji by Boschma (1953), *D. fisheri* Broch, *D. livida* Tennison-Woods, and *D. violacea* (Pallas). In his later review of the genus, Boschma (1959) synonymized *D. fisheri* with *D. violacea*. *D. livida* was considered a *species dubia* in Boschma's review, and its occurrence in Fiji rests on a single 'tentatively identified' specimen (Boschma, 1959). *D. coccinea* Gray, as defined by Boschma, might be expected from Fiji, since it is known from the Great Barrier Reef, New Caledonia, Samoa and Kiribati (formerly Gilbert Islands) but seems not to have been recorded so far. *D. violacea*, red and straw coloured as well as violet, was seen near the reef edge at many localities. *Stylaster sanguineus* Valenciennes in Milne Edwards and Haime, listed from Fiji by Boschma (1953, 1957), was seen less commonly but still from several localities.

Living hydroids are often of distinctive colour. In the present collections for example, the living hydrocladia of *Macrorhynchia philippina* (which stings painfully) were opaque white, contrasting with the black stem; *Gymnangium eximium* was brilliant yellow; *Thyroscyphus fruticosus* was often flushed with violet; and *Zygophylax rufa* was

mahogany. Most specimens were preserved in formaldehyde (4% in sea water) or, if associated with required calcareous fauna, in 70% ethanol. Most of the hydroids lost their pigmentation in these preservatives. We are aware of the general lack of descriptions based on living material: for example, nematocysts, tentacle number and attachment of the hydranth to its theca. Attention has been drawn to the general lack of data on tentacle number and descriptions of hydranths elsewhere (Ryland and Warner, 1986; Cornelius, 1987), and future observations should try to redress these omissions.

Material for slide preparation was stained in Grenacher's borax carmine for approximately 1½ hours and differentiated in acid alcohol (0.5% HCl in 70% ethanol) for at least the same time again. Following transfer to 90% ethanol for half an hour, the material was treated with a weak solution of fast green (0.075% in 90% ethanol) for 15 to 90 seconds. It was then dehydrated using absolute alcohol and cleared in xylene. Dirty colonies were dealt with in a number of ways prior to staining: immersion in a 15% solution of glycerol, to attempt mucus dissolution, followed by vigorous washing under a running tap and/or treatment in an ultrasonic cleaner with subsequent bubble removal in a vacuum oven.

The success of the double-staining technique depends largely upon the age of the material and, hence, perisarc thickness: campanulariid and plumulariid hydroids (with the exception of certain thickly polysiphonic aglaophenines) required only 1½ hours in acid alcohol and minimum time in fast green; whereas thicker material, such as *Thyroscyphus fruticosus* needed up to two days in acid alcohol and 90 seconds in fast green. The desired result is a preparation in which the coenosarc and hydranths are stained red and the perisarc is pale blue; to obtain top class results we recommend initial experimentation. Staining of the perisarc has great advantage, particularly facilitating the examination of small structures such as plumulariid nematothecae.

Material has been deposited in the British Museum (Natural History), 4-part register numbers preceded by BM, and the Queensland Museum, number preceded by QM GL.

COLLECTING STATIONS

Collections were made by JSR, or by the colleagues indicated (especially Dr N. Penn) using SCUBA techniques, at 32 stations around Viti Levu and Kandavu (Fig. 1). In addition, a sample was obtained fortuitously from 1,000 m (Sta. 6) off Suva. Brief descriptive notes on locations follow, the absence of specified dates indicating that several visits were made.

1. Tailevu Point. A silty, low diversity fringing reef some 400–500 m in width lying in the shelter of Ngomma and Ngomma Lailai islands. The part visited extended northwards as far as Nggelekuro village. The reef flat was barren, but holes and channels near the reef edge contained some flourishing coral with, e.g., *Lytocarpia brevirostris* and *Stylaster sanguineus*. Coral, mainly *Acropora humilis* (Dana), and a few other cnidarians, including gorgonians, were present on the reef front at low water of spring tides (LWST).
2. Nukulevu, 27 May 79. A sheltered island 5.5 km SSE of Tailevu Point. *Lytocarpia phyteuma* was collected at 0.5–2 m off the reef just north of Nukulevu.
3. Thangilai, 28 Apr. 79. A cay and reef SW of Ovalau, exposed to the ESE through Moturiki Channel. Abundant alcyonaceans; a few hydroids.
4. Mambualau, 14 May 79, 3 Jul. 80. A small limestone (fossil reef) island, about 0.5 km from the open ocean, in a reef complex which stretches 20 km from Moturiki Channel to Tomberua Passage, approached from the land over 4.5 km of shallows.
5. Tomberua Pass, 3 Jul. 80. Accessible semi-exposed fore-reef east of Kamba Point (the easternmost 'finger' of Viti Levu). The Navuloa mouth of the Rewa opens inside the lee of this point.
6. Samples were obtained from a prawn trap set at a depth of about 1,000 m, seawards of Makuluva cay.
7. Great Astrolabe reef, NE of Ndravuni Island, 23–4 Jun. 78, 23–4 Jul. 78, 11–12 Jul. 80. Oceanic. The reef flat rarely dries, even at LWST. Sandy channels about 1 m wide transect the reef, allowing access to the wavebreak zone. The channel sides supported an abundance of hydroids, such as *Gymnangium eximium, G. hians, Lytocarpia brevirostris* and *L. phyteuma*. Specimens were also collected in the back-reef area, facing the lagoon.
8. Fringing reef dominated by *Acropora humilis* on the leeward side of Yaukuve Levu, in the Great Astrolabe lagoon, 12 Jul. 80.
9. Herald Pass, leeward from Ndravuni, 24 Jun. 78, at about 27 m (collections by C. Wright).
10. Joske's reef, 18 Sep. 78, Offshore fringing

reef with extensive flat; seaward edge about 2 km from Namuka island. A rich cryptic fauna, including several hydroid species, present under coral boulders to the west of the pass.

11. Pratt reef, north of Mbengga island, 3 Nov. 79. Site was NE edge of Pratt reef, exposed to refracted swells and seas, with strong tidal flow. Coral outcrops ('bommies') rise from the sea bed at about 12 m depth to within 1 m of the surface. Gorgonians noted as abundant in water as shallow as 2 m. Hydroids collected from the bommie, 1–5 m (N. Penn).
12. Ndeumba. A small, sheltered reef fringing a platform, apparently of raised reef resting on conglomerate, around a promontary at the west end of Taunovo Bay, 8 km west of the Ndeumba mouth of the Navua river. The reef front drops to sand at 1.5–3 m. The water was almost invariably turbid. The reef front was notable for the abundance of *Macrorhynchia philippina*, obtained nowhere else, and for small crevasses at about LWST which were a rich site for hydroids such as *Zygophylax rufa* and the small form of *Gymnangium eximium*. The eastern end of the reef, where it merges with the beach of another sandy bay, was exposed to continuous wave chop, and was carpeted with red algae (? *Laurencia*), with some *Sargassum* sp. Numerous hydroids, particularly *Clytia hemisphaerica* and *C. edentula* sp. n., *Sertularia borneensis, S. hupferi, S. turbinata*, and *Monotheca obliqua*, were collected on these algae.

    The site was last visited on 1 Jun. 80, two months after the devastating rainfall of cyclone 'Wally' (detailed by Harris, 1980). Some account of the cyclone, and of the effects of the consequent severe flooding on south coast reef biota, have been given by Ryland *et al.* (1984). The Navua river catchment suffered severe flooding and damage, the peak river discharge being estimated at 6050 m^3 s^{-1} (normally 45). Extensive landslides produced a huge sediment load and a 0.6 m deposit on the flood plain around Navua town (Harris, 1980). The scleractinian corals, *Millepora*, and alcyonaceans formerly prevalent on the Ndeumba reef, were all dead. Extensive deposits of red soil were still present on the foreshore of nearby Ngaloa on 16 Aug. 1980.
13. Frigate Pass, the first break from the leeward end of Mbengga barrier reef, 2 Nov. 79. Collections were made on the western, dissected side of a 'bommie' rising from the sea bed at about 18–25 m depth to within about 3 m of the surface. Luxuriant coral growth, antipatharians, and other sessile forms. Hydroids from 3–10 m (N. Penn).
14. Yanutha reef, the northerly of the two reefs seaward of Yanutha island, 7 Oct. 79. A dive was made at the northern tip of Yanutha reef on 2–3 m wide crevasses between 'bommies' rising from the sea bed at about 25 m depth to within 1 m of surface; strong tidal flow but relatively sheltered from wave action. Gorgonians up to 2 m across growing vertically at right angles to the 'bommie' sides; 0–20 m (N. Penn).
15. Ngaloa. 15 Jun. 79. Hydroids were collected just sublittorally of the landward side of a reef some 100 m offshore (N. Penn).
16–20. 'Coral Coast' fringing reefs. Sites visited correspond to passes associated with discharge from creeks: (16) Minora Ck, Votualailai, W side; (17) Tangangge Ck, E side; (18) Undu Ck, Namanda, W side; (19) Mbulu Ck, Malevu, W side; (20) Korotongo Ck, W side. Some account of the habitats and biota of these reefs has already been given (Ryland, 1982; Ryland *et al.*, 1984). The levees flanking the passes provide quick acccess to the reef front, 0.6–1.0 km offshore. Collections were made from various zones of the reef, mostly near the pass. The accessible habitats on these reefs seemed to support few hydroids (*cf.* stations 7 and 12).
21. Malolo Lailai; lagoon floor, west side of island (A. Muirhead).
22. Vunda Point fringing reef, 12 Jul. 79, 3 Sep. 79, 17 May 80. A barren, sediment-covered flat up to 700 m across, dominated by variously coloured clones of a species of *Zoanthus. Dynamena crisioides* seemed to be the only hydroid present. The surrounding water was very turbid and the reef edge too brittle successfully to approach from the land.

    Navini island, a patch reef and cay in Nandi Waters, 14.5 km W of Vunda, was also visited. Despite the prolific sublittoral coral fauna (Ryland, 1982), no hydroids were obtained.
23. The SE corner of Yarawa reef, 17 km N of Mba town and 6 km NNE of the low water mouth of the Mba river. The reef is normally well clear of turbid water, though this can reach the reef at times of flood. The boundary between lagoon and clear ocean water was

noted to be at the seaward end of the Mba and other passages during a dry spell in August 1978. Salinity in the vicinity of Yarawa reef was 33°/₀₀. This was the only offshore platform reef in the lee of Viti Levu that was visited, and it was markedly different from the other sites. Extensive notes were taken describing the southeastern corner, near the beacon, during a visit on 8–9 Aug. 78 (Institute of Marine Resources, University of the South Pacific, internal report, 1978) and on 30 Jul. 80.

The main reef area, the flat, stayed covered with 12–18 cm water at low tide. Leaving the flat, the reef surface first ascended slightly (the rubble zone), declined into a discontinuous shallow moat, ascended again (the summit), and sloped for some 30 m into the sea, where the reef edge was jagged and the front dropped to chart depths of 27–40 m. The seaward slope, superficially appearing solid, in fact contained deep channels, inlets, caves, and blowholes, in which were plate-like growths of *Montipora* sp. and *Echinopora lamellosa* (Esper). Coral cover varied from 25 to 75%, and was richest at the very edge; coral-free areas were dominated by crustose coralline algae. In parts the dominant coral was *Acropora formosa* (Dana), with *A. humilis*, various faviids, and *Lobophytum*. Notable absentees were *Millepora, Distichopora, Tubipora, Pocillopora* spp. other than *P. damicornis* (L.), zoanthids (except occasional *Palythoa*), *Xenia*, coralline turf, and macroalgae, seen elsewhere but presumably an assemblage characteristic of windward reefs.

The summit was characterized by an efflux of water draining from the flat. Where there were pools coral flourished; elsewhere the cover was only 10–15%, mainly *Acropora humilis*. Scattered small heads of *Palythoa*, *Lobophytum* and *Sinularia* were present. The summit pools merged into a narrow moat where, in places, water lay up to 1 m deep. Inshore of the moat, the rubble zone consisted of *Acropora* shingle and dead, inverted *Acropora* heads. This zone was dry at low tide, but under the boulders and amongst the shingle lived a rich cryptofauna. Coral species included *Montipora digitata* Dana, *A. formosa, P. damicornis, Porites* and *Goniastrea*, with holothurians, varied infaunal crustaceans, and an under-boulder sessile fauna of bryozoans, sponges, ascidians, the foraminiferan *Homotrema rubrum* (Lamarck), and hydroids, together with a notably rich gastropod assemblage.

The reef-flat 'lagoon' contained areas dominated by the coralline alga *Amphiroa*, flat, wide microatolls of *Porites* (again in contrast to the windward reefs), *Fungia, Pocillopora damicornis, Pavona divaricata* Lamarck and *Pavona decussata* (Dana). Clumps of algae such as *Halimeda* spp., *Padina gymnospora* (Kuetz.) Vickers, *Turbinaria ornata* (Turner) J. Ag., a loose *Sargassum* (the last two pilose with *Jania*), and the sea grass *Halophila*, probably *H. minor* (Zoll) den Hartog (see Penn, 1983), *Dynamena crisioides* and the ascidian *Lissoclinum bistratum* (Sluiter) were abundant on the rubble. Further into the 'lagoon' the patches of sand increased in area, and *L. bistratum* was restricted to the clumps of *Halimeda* (most of the reef-flat ascidians characteristic of windward reefs (Ryland *et al.*, 1984) being absent).

24. Mba flats, 8–9 Aug. 78. An extensive sand fan had accumulated at the mouth of the Mba river, its level being too low for colonization by the mangrove *Rhizophora stylosa* Griff. In parts the sand was coarse (diameter mainly >0.4 mm), elsewhere silt occurred, with fine sand dominant (particles in the range 0.1–0.4 mm). Two sea grasses were present, *Halophila ?minor* and *Halodule pinifolia*, together with the green alga *Enteromorpha*, the red alga *Gracilaria secundata* Harvey, and seedlings of *R. stylosa*. The *Gracilaria* generally supported a felt of filamentous Ectocarpaceae admixed with two campanulariid hydroids *Clytia hemisphaerica* and *Obelia bidentata*. During the Institute of Marine Resources visit, 8–9 Aug. 78, salinity in the channel through the flats was recorded as 26°/₀₀ (LW) and 32°/₀₀ (HW). These might be expected to drop dramatically at times of flood.

25. Suva barrier reef, Levu Passage, near the harbour entrance, the 'Fish Patch'. The 'Fish Patch' is a ledge, some 150 x 80 m, at a depth of 10–12 m, slightly seaward of the reef front, notable for the abundance of the fungiid *Zoopilus echinatus* Dana. It is a generally sheltered locality subject only to weak tidal currents. Hydroids were collected from the 'Fish Patch', 3 Jun. 80, and down to 30 m on its seaward wall, this dropping vertically for over 100 m, 21 Nov. 79, 3 Jun. 80 (N. Penn).

26. Nesese, Suva, 7 Aug. 79 and 31 May 80.

Sheltered foreshore with reef of *Goniopora* and *Porites* reached by wading from Nesese (west of the creek). Two species of *Sargassum* (especially 'sp. 2' of Morton and Raj, 1980) with bryozoans and compound ascidians; *Dynamena crisioides* was the only hydroid.

27. Suva barrier reef, SW bight, 19 Feb. 80. Fore-reef slope with well developed spur and groove formation, 0–9 m; slope rubble covered, 9–20 m; drop-off at 20 m. Exposed (through less so than Sta. 28). Hydroids collected at 3–9 m (N. Penn).
28. Suva barrier reef, southernmost point (offshore from Suva Point), 3 Apr. 79. Extremely exposed, with classic spur and groove structure. Hydroids from 3–12 m (N. Penn).
29. Extensive muddy-sand flats off Veiuto, Suva Point, bounded at LWST by three navigational beacons, described by Morton and Raj (1980, Pt. VI). A sparse covering of the sea grasses *Halophila ?minor* and *Halodule pinifolia*, together with the algae *Halimeda macroloba* Dcne. and *Gracilaria secundata*, offered the only substrata for hydroids.
30. Back of Suva barrier reef, opposite University Campus. Shoal at 4–6 m marked with black navigational beacon.
31. Wave-break zone and fore-reef flat of Suva barrier reef, opposite University Campus. This site, and the fauna associated with boulders, has been described by Dilly and Ryland (1985).
32. Site similar to 31 but on Nukumbutho reef.
33. Nukulau (Makuluva) Pass. Very exposed SW front of Makuluva reef. Surge channels to depth of 12 m, rubble slope to 25 m. Luxuriant reef, despite proximity to Rewa river mouths. Dive 0–23 m, 2 May 80 (N. Penn).

SYSTEMATIC ACCOUNT

Order ATHECATA
Family BOUGAINVILLIIDAE
Incertae sedis

DESCRIPTION

Stem monosiphonic, colony reaching an observed height of 8 mm. Branches short, alternate, in many planes. Hydranths terminal, at the ends of both stem and branches. Perisarc extending over column of hydranth and terminating below the tentacles as a pseudohydrotheca: annulated at the base. Hydranth of varied shape, with conical hypostome. Tentacles filiform, 14–18, concentrated at or near the oral end, in 1–3 close whorls. Gonophores not observed.

The absence of gonophores and the variable number of tentacular whorls make the assignment of this material to genus impossible.

OCCURRENCE IN FIJI

On coral boulder, crest of Suva barrier reef; 27 Apr. 79.

Family CLAVIDAE
Tubiclava Allman, 1863
Tubiclava sp. (Fig. 2)

DESCRIPTION

Colony comprising solitary hydranths united by a common hydrorhiza; maximum height 2.5 mm. Hydrorhiza covered by firm perisarc extending 0.6–1.1 mm to base of pedicel, leaving most of the latter and all the hydranth naked; difficult to differentiate pedicel from hydranth. Hydranth non-retractile, with conical hypostome and variable number of irregularly arranged filiform tentacles, sometimes distributed in weak whorls. Gonophores not observed.

OCCURRENCE IN FIJI

Under coral boulder, Nukumbutho reef flat; 11 Jun. 80 (QM GL10173).

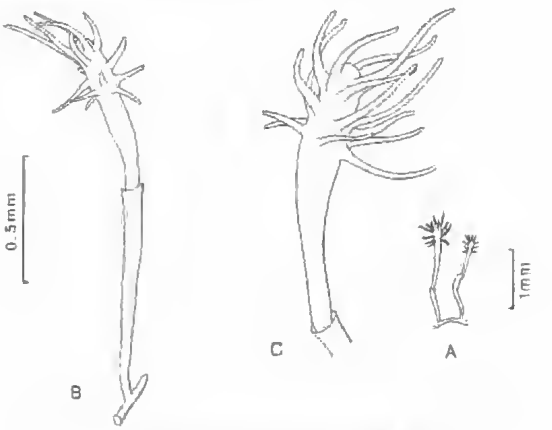


FIG. 2. *Tubiclava* sp., Nukumbutho reef (QM GL10173)

Family EUDENDRIIDAE
Eudendrium Ehrenberg, 1834
Eudendrium sp. (Fig. 3)

DESCRIPTION

Colonies up to 30 mm in height. Stem monosi-

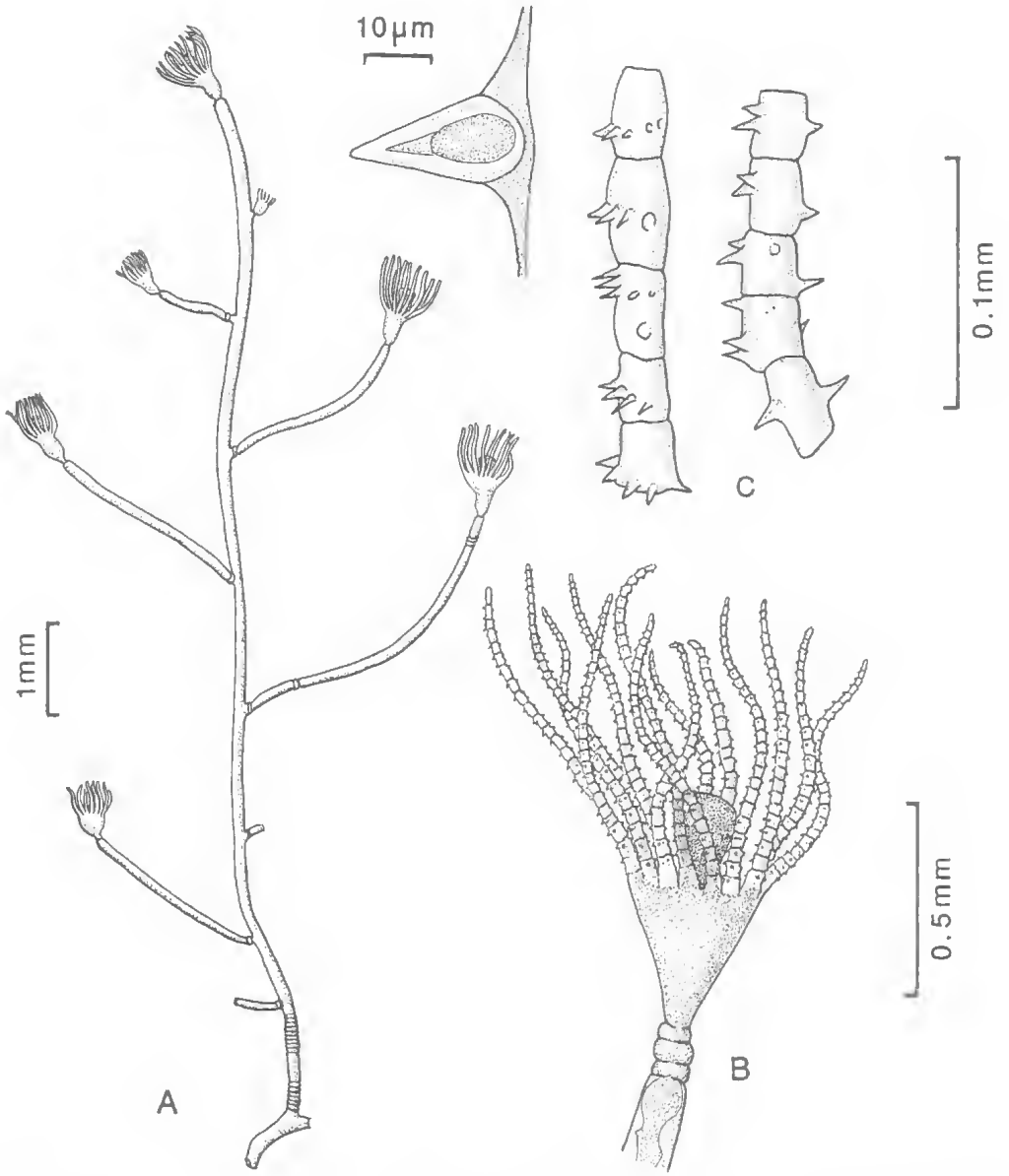


FIG. 3. *Eudendrium* sp. A, colony; B, hydranth; C, parts of tentacles; D, nematocyst. Votualailai (QM GL10174)

phonic, branching alternately; with 1–2 annulations at the bases of branches and irregularly along their length; perisarc tubes otherwise smooth. Hydranth with 16–24 long filiform tentacles; these with regular transverse nematocyst batteries and numerous, irregularly scattered short cnidocils. Gonophores absent.

OCCURRENCE IN FIJI

On boulder, crest of Suva barrier reef, 27 Apr. 79; Sta. 27, N. Penn coll., 19 Feb. 80; Votualailai, 9 Aug. 79 (QM GL10174).

Family CORYNIDAE

Coryne Gaertner in Pallas, 1774

Coryne sp. (Fig. 4)

DESCRIPTION

Stem monosiphonic; colony reaching 9 mm.

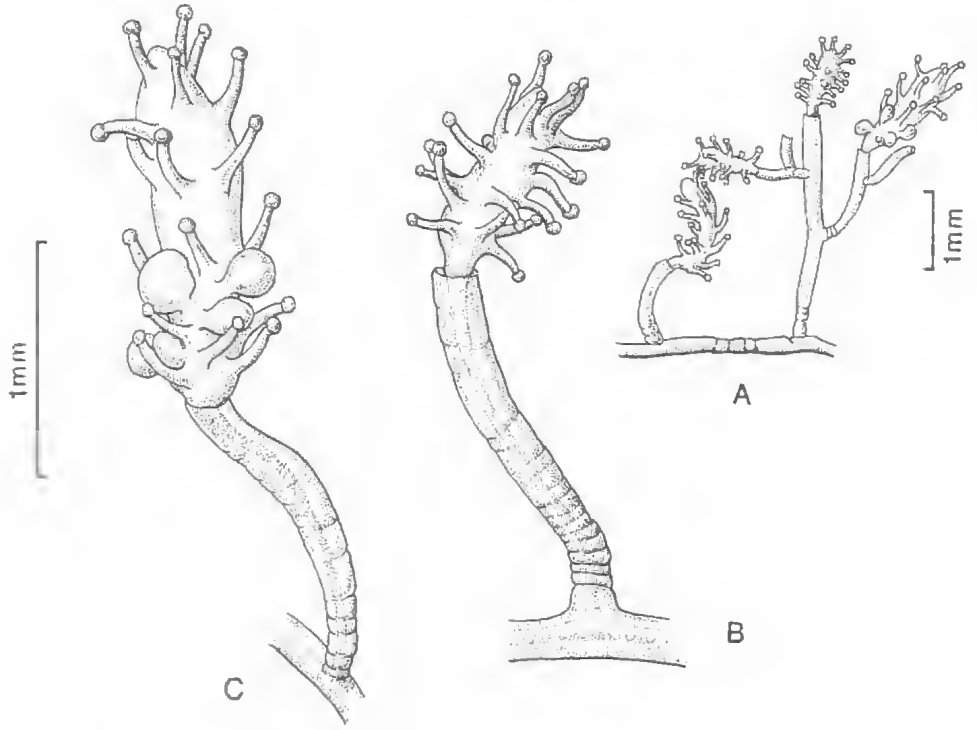


FIG. 4. *Coryne* sp., Yarawa reef (QM GL10175)

Hydranths arising from hydrorhiza or hydrocaulus. Branching irregularly alternate. Perisarc firm, extending to just below hydranth and annulated at the base of stem and branches; also indistinctly throughout, giving the impression of corrugation. Hydranth spindle-shaped with conical hypostome; tentacles 16–24 short, all capitate, in 4–5 indistinct whorls. Gonophores interspersed with the basal tentacles, each in the form of rounded sporosacs, often with a nipple-like protuberance at the distal end.

OCCURRENCE IN FIJI

One record, under coral boulder, Yarawa reef; intertidal; 8 Nov. 78 (BM 1984.5.17.4; QM GL10175).

Family PENNARIIDAE
Pennaria Goldfuss, 1820

The genus *Pennaria* was first introduced by Oken (1815: 93) to accommodate *P. lendigera*, 'Nisskoralline' (a new introduction for *Sertularia lendigera* Linnaeus, 1758: 812, a bryozoan now placed in *Amathia*. Also listed were seven other species then known as *Sertularia*, all thecate hydroids. *Sertularia Pennaria* Linnaeus, 1758 (p. 813) was not among them.

The International Commission on Zoological Nomenclature (ICZN) ruled, in Opinion 417 (1956), that no name published by Oken in his 'Lehrbuch' (1815) acquired the status of availability in zoological nomenclature by virtue of having been so published. *Pennaria* Oken, 1815, thus has no status, no validity in zoological nomenclature, and no influence on any subsequent use of the name. We are grateful to Dr R.V. Melville (*in litt.*, 11 Mar. 1985) for confirming that the view which we are advancing here is nomenclaturally correct; the significance of the ICZN ruling seems to have been misunderstood by several workers, most recently by Calder (1988).

Sertularia Pennaria Linnaeus, 1758, from examination of its type at the Linnean Society of London, is a large aglaopheniine hydroid collected by G.W. Steller, probably from Kamchatka and not, as Linnaeus indicated, from the Indian Ocean (Cornelius 1979: 309, Note 14). Cavolini (1785, p.134; Pl. 5), evidently mistaking an athecate hydroid known to himself in Italy for the Linnean species, described as 'la Sertolara Pennara' (*Ser-*

tularia Pennaria in Sprengel's 1813 translation) the Mediterranean species now well-known as *Pennaria disticha* Goldfuss, 1820 (e.g., Brinkmann-Voss, 1970).

Pennaria Goldfuss, 1820: 89, was established to accommodate two species, *P. disticha* Goldfuss, 1820 ('Sertolara Pennara' of Cavolini) and *P. parasitica* Goldfuss, 1820 ('Sertolara parassita' of Cavolini). The genus was properly introduced and, in view of the ICZN ruling (Opinion 417, 1956), is a valid zoological name; it did not, and does not, require validation under the ICZN Plenary Powers (*cf.* the situation for *Halecium* Oken, p. 390). It has no connexion with Oken's *Pennaria*, based on *Amathia lendigera*, or with Linnaeus' *Sertularia Pennaria*. Hirohito (1977) stated that *Pennaria* Goldfuss was preoccupied by *Pennaria* Blainville, 1818, a genus of Polychaeta. Hirohito gave no reference to back up this statement which appears to be based on the entries under 'Pennaire' and 'Pheruse' (Blainville, 1818, pp.158, 520–21 respectively), in which Blainville proposed 'Pennaire' to replace *Pherusa* Ocken [sic], a genus of Polychaeta, preoccupied by *Pherusa* Lamouroux, a genus of Bryozoa. Blainville's use of Pennaire does not constitute a valid introduction, since the latinized form *Pennaria* was not used.

Allman (1872: 368) maintained *Pennaria* for *P. disticha* Goldfuss but introduced *Halocordyle* for the similar American species *Globiceps tiarella* Ayers, 1854: 193, on the grounds that the capitate tentacles were in verticils rather than being irregularly dispersed over the hydranth. A more usual view (Millard, 1975) is to regard *P. disticha* and *G. tiarella* as congeneric, or even conspecific (Garcia-Corrales and Aguirre, 1985; Calder, 1988), and hence, until recently, usually placed in *Pennaria*. The two nominal species are reportedly widely distributed in the tropics and subtropics and *Pennaria* has become a very familiar name. More recently, some authors (e.g., Millard, 1975; Hirohito, 1977; Watson, 1982; Calder, 1988), following Stechow (1922) rather than the more recent ICZN ruling, have adopted *Halocordyle*. Others (e.g., Brinkmann-Voss, 1970) have not. However, it seems clear from the foregoing discussion that, since *Pennaria* Oken must be set aside, *Halocordyle* becomes a subjective synonym of *Pennaria* Goldfuss, and Stechow's argument is superseded.

Furthermore, *Halocordyle* Allman, 1872, is the junior subjective synonym of *Eucoryne* Leidy, 1855 (which Allman mistakenly assumed to be preoccupied by *Eucorynus* Schoenherr, a genus of Coleoptera). To maintain *Halocordyle* as the name for the present genus would thus require the International Commission on Zoological Nomenclature to set aside not only *Eucoryne* Leidy, which might present no problem, but *Pennaria* Goldfuss as well.

Which generic name would best promote nomenclatural stability? Suppressing either *Pennaria* or *Halocordyle* will inevitably cause confusion (though this exists already: Dunn's, 1982, classification of Cnidaria retains both). For *Halocordyle* it can be argued that most specialist works on Hydroida since 1975 and a few more popular books have used it; *Pennaria*, however, is the name still used in the more general field guides (e.g., Gosner, 1979) and zoology textbooks, including the various editions of Barnes' influential *Invertebrate Zoology* (5th ed. 1987). In the circumstances, the best solution to an unsatisfactory state of affairs seems to be to follow the Code.

According to Bedot (1901: 459) *P. disticha* is the type species of *Pennaria* Goldfuss, but we have not searched for an earlier designation.

Pennaria disticha Goldfuss, 1820
(Fig. 5)

Pennaria disticha Goldfuss, 1820: 89
Pennaria australis Bale, 1884: 45
Halocordyle disticha (Goldfuss, 1820): Millard 1975: 41

DESCRIPTION

Stems upright, monosiphonic but with a firm perisarc, reaching 65 mm; pinnate; main stem divided by variably annulated nodes into regular internodes, each bearing a distal hydrocladial apophysis. Hydrocladia alternate, in plane of stem, of variable length, those in the middle tending to be longest; multi-annulated at base and divided by annulated nodes into internodes, each with a distal ramule on its upper surface. Ramules unsegmented but annulated for most of their length.

Hydranths borne at the ends of stems, hydrocladia and ramules; with a basal whorl of 10–15 filiform tentacles, longer than the hydranth body, and 10–22 short capitate distal tentacles irregularly scattered or arranged in a loose verticil. Hypostome conical.

Gonophores borne between the two sets of tentacles, small, pear-shaped, shortly pedicellate.

VARIATIONS

Length of ramules on hydrocladia decreases distad. Length of filiform tentacles variable in

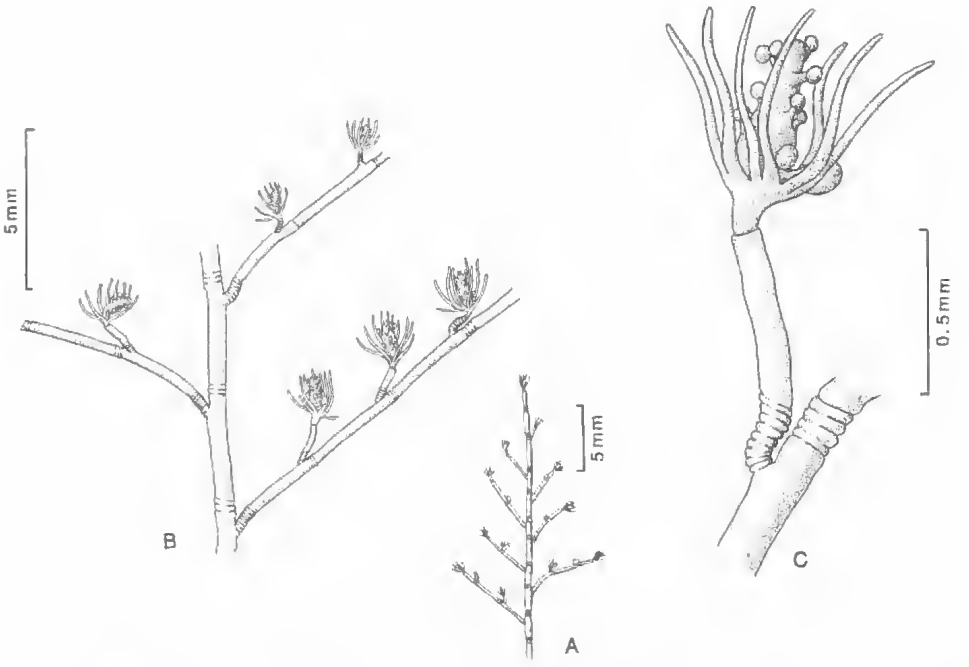


FIG. 5. *Pennaria disticha* (A, habit sketch; B, portion of stem with hydranths; C, hydranth (QM GL10176) Joske's reef

preservation but always greater than the height of the hydranth. The amount of annulation on the stem, hydrocladia and ramules is now recognized as being highly variable, and Millard (1975: 41) consequently referred *Pennaria australis* Bale, 1884, to *P. disticha*.

OCCURRENCE IN FIJI

Always present in the wavebreak zone of the reefs near Suva (Nukumbutho, Suva (BM 1984.5.17.1, 2), Joske's (QM GL10176)) attached to boulders, in clefts or growing in the algal turf. Gonophores recorded April and June-September. Also Christmas I. (Line Is), 18 Feb. 79.

WORLD DISTRIBUTION

Circumglobal in tropical to warm-temperate waters, with the nominal species *P. tiarella* (Ayers) included in the synonymy of this species (Garcia-Corrales and Aguirre, 1985; Calder, 1988) providing many of the New World records.

Pennaria wilsoni Bale, 1913
(Fig. 6)

Halocordyle australis Bale, 1894: 94

Pennaria wilsoni Bale, 1913: 116
Halocordyle wilsoni (Bale, 1913): Pennycuik 1959: 160

DESCRIPTION

Stem upright, monosiphonic but with firm perisarc, reaching 35 mm; pinnate; stem divided by nodes into regular internodes, each bearing a hydrocladial apophysis at the distal end and a variable number of annulations at the nodes. Hydrocladia alternate, of variable length, in plane of stem, at about 45° to the axis; annulated at the base, non-segmented and smooth from base to apex, sometimes with a few terminal annulations.

Hydranths borne at the ends of stem and hydrocladia; basal whorl of 7–8 filiform tentacles shorter than hydranth body, thick and slightly clavate in preserved material, usually orthogonal to hydranth; oral whorl of 5–6 short capitate tentacles distally, tightly packed and directed upwards. Hypostome conical; length and shape of hydranth body variable in preserved material.

Gonophores borne on the hydranth body betwen the basal and oral tentacles, whorls large and spherical.

REMARKS

This material resembles closely the description of Pennycuik (1959) but less so those of Bale (1894)

and Watson (1982). The two last describe *P. wilsoni* as having several, alternately arranged hydranths per hydrocladium rather than one terminal hydranth. The single whorl of oral capitate tentacles is a specific character agreed by all authors. In the Fijian material the hydrocladia branch at about 43° (31–55°) to the stem axis, whereas in *P. disticha* the mean angle is 50° (38–62°).

Occurrence in Fiji

Reef-edge algal turf, Suva barrier reef (BM 1984.5.17.3; QM GL10177/8/9). It seems surprising to find this fragile looking hydroid in such a high energy environment.

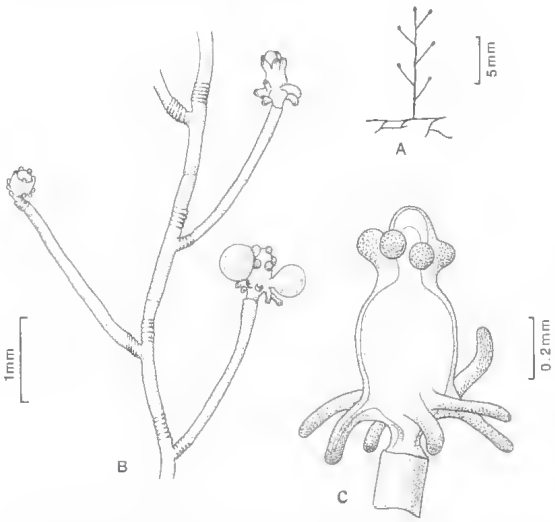


Fig. 6. *Pennaria wilsoni*. A, habit sketch; B, portion of stem with hydranths and gonophores; C, hydranth. Suva Barrier reef (QM GL10177).

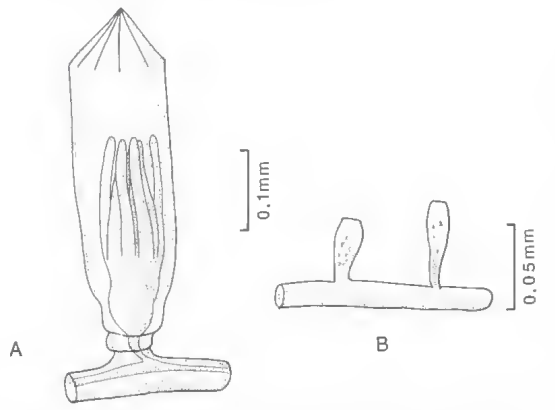


Fig. 7. *Egmundella amirantensis*. A, hydranth; B, nematotheca. Suva barrier reef (QM GL10181).

World Distribution

Great Barrier Reef: Low Isles (Pennycuik, 1959), Victoria (Bale, 1913; Blackburn, 1937).

Family TUBULARIIDAE
Tubularia Linnaeus, 1758
Tubularia sp.

A small colony with unbranched stems about 10 mm high and 0.3 mm diameter was obtained under coral rock on Suva Barrier Reef, eastern end, on 25 Jul. 78 (QM GL10180). Hydranths were incipiently fertile with small, 3–5 lobed blastostyles forming just above the aboral ring of tentacles. Not possible to identify to species.

Family ZANCLEIDAE
Zanclea Gegenbaur, 1856
Zanclea sp.

Occurrence in Fiji

A few zooids on unidentified Bryozoa, under boulders, crest of Suva barrier reef; 29 Mar. 79, 27 Apr. 79.

Order THECATA
Family CAMPANULINIDAE
Egmundella Stechow, 1921
Egmundella amirantensis Millard and Bouillon, 1973
(Fig. 7)

Egmundella amirantensis Millard and Bouillon, 1973: 40
Egmundella amirantensis Millard and Bouillon, 1973: Millard 1975: 133

Description

Colony epizoic on other hydroids; stolonial. Hydrothecae arising from hydrorhiza; shortly pedicellate or almost sessile; more or less cylindrical but of variable height; rounded at the base. Operculum composed of an uncertain number of delicate segments, which are not strongly demarcated from each other or from the thecal wall. Diaphragm not observed.

Nematothecae present on the hydrorhiza; tubular, without pedicel; narrowed at base and rounded distally. Long, slender nematocysts sometimes visible. Gonothecae not observed (for description see Millard, 1975).

MEASUREMENTS (μm)

Hydrotheca: height 130–225; diameter 45–65. Nematotheca: height 35–50.

REMARKS

Our material closely resembles the holotype slide of *E. amirantensis* in the South African Museum (SAM H 2917)

OCCURRENCE IN FIJI

Epizoic on *Tubularia*, Suva barrier reef flat, 25 Jul. 78 (QM GL10181).

WORLD DISTRIBUTION

Southern Africa, Seychelles.

Family HALECIIDAE
Halecium Oken, 1815

The generic name *Halecium*, invalidated in a general ruling on Oken's names by the International Commission on Zoological Nomenclature (1956), has subsequently been declared valid (ICZN, 1982). Hydrothecal regeneration is common in *Halecium*: the original hydrotheca is usually termed primary, the first regeneration secondary, and so on (Millard, 1975).

Halecium sibogae Billard, 1929
(Fig. 8)

Halecium sibogae Billard, 1929: 307.

DESCRIPTION

Colony shrubby; branching irregularly alternate; reaching 40 mm; polysiphonic near the base. Stem and branches divided by oblique nodes into regular internodes, which diverge alternately left and right, creating a slightly geniculate appearance. Each internode bearing a hydrotheca on a distal apophysis, the adcauline side of which is thickened and distinctly comma-shaped in side view. The two series of hydrothecae in one plane or shifted slightly anteriorly. Internodes non-annulated.

Primary hydrotheca sessile, with adcauline wall free from stem: secondary hydrothecae stalked, the pedicels with basal constrictions, slightly gibbous above, narrowed then expanding distad. Hydrothecae shallow with straight sides, widening slightly; margin everted, though the delicate cup is so liable to damage that the everted margin often difficult to see. Diaphragm straight and with a ring of desmocytes (refringent granules) above.

Gonotheca arising from within a hydrotheca, globular or ovoid, shortly pedicellate. Aperture on short collar, slightly squared, with small indistinct horns at each corner; no accompanying hydranth.

MEASUREMENTS (μm)

Hydrotheca: depth 30–50; marginal diameter 180–220. Internode: length 640–800; width 150–180. Gonotheca: height 1183–1547; maximum width 1019–1310; aperture diameter 255–364.

REMARKS

The gonothecae immediately eliminate other species such as *H. beanii* (Johnston, 1838), *H. halecinum* (Linnaeus, 1758), and *H. sessile* Norman, 1867, with which this species might otherwise be confused. In identifying this material as *H. sibogae*, we have been particularly influenced by Billard's illustration (1929, fig. 1B) and his description of the comma-shaped perisarcal thickening (as seen in side view, see Fig. 8) on the adcauline side of the apophysis which, if present on the other species, is not as obvious. Many of the hydrothecae in the Fiji material do not have the everted margin (as explained above) stressed by Billard.

OCCURRENCE IN FIJI

On coral head, 3–8 m, Frigate Pass, Mbengga leeward barrier reef; reproductive; 2 Nov. 79 (BM 1984.5.17.5; QM GL10182/3).

WORLD DISTRIBUTION

Indonesia (Billard, 1929).

Halecium sp. 1 (Fig. 9)

DESCRIPTION

Colonies small, <3 mm high, variable in shape. Stem monosiphonic; branching irregular, weakly sympodial. Internodes narrow basally, much wider distally; slender or with irregular corrugations at the base. Branches typically arising from posterior surface of internode below. Hydrothecae terminating each internode, with apophysis of the subsequent internode immediately below. Primary hydrothecae sessile; secondary hydrothecae shortly pedicellate. Tiers of secondary hydrothecae common. Pedicel typically symmetrical, often constricted at base and gradually widening distad; apophyses of variable length. Hydrothecae shallow, flaring; margin strongly everted. Diaphragm delicate, with a ring of large desmo-

cytes immediately above it. Gonothecae not observed.

MEASUREMENTS (μm)

Measurements for *H. reflexum* from Vervoort (1968) are in parentheses.

Hydrotheca: marginal diameter 175–270 (120–165); depth 20–50 (13–30). Internode: length 190–460 (175–440).

REMARKS

Athecate internodes were not observed. This material differs from *H. tenellum* Hincks, 1861, and *H. reflexum* Stechow, 1919a, by the irregularly sympodial way of branching, the absence of athecate internodes, and the larger hydrothecae. However, as we have not seen gonothecae, and both of the above species are morphologically very variable, no decision on identity was possible.

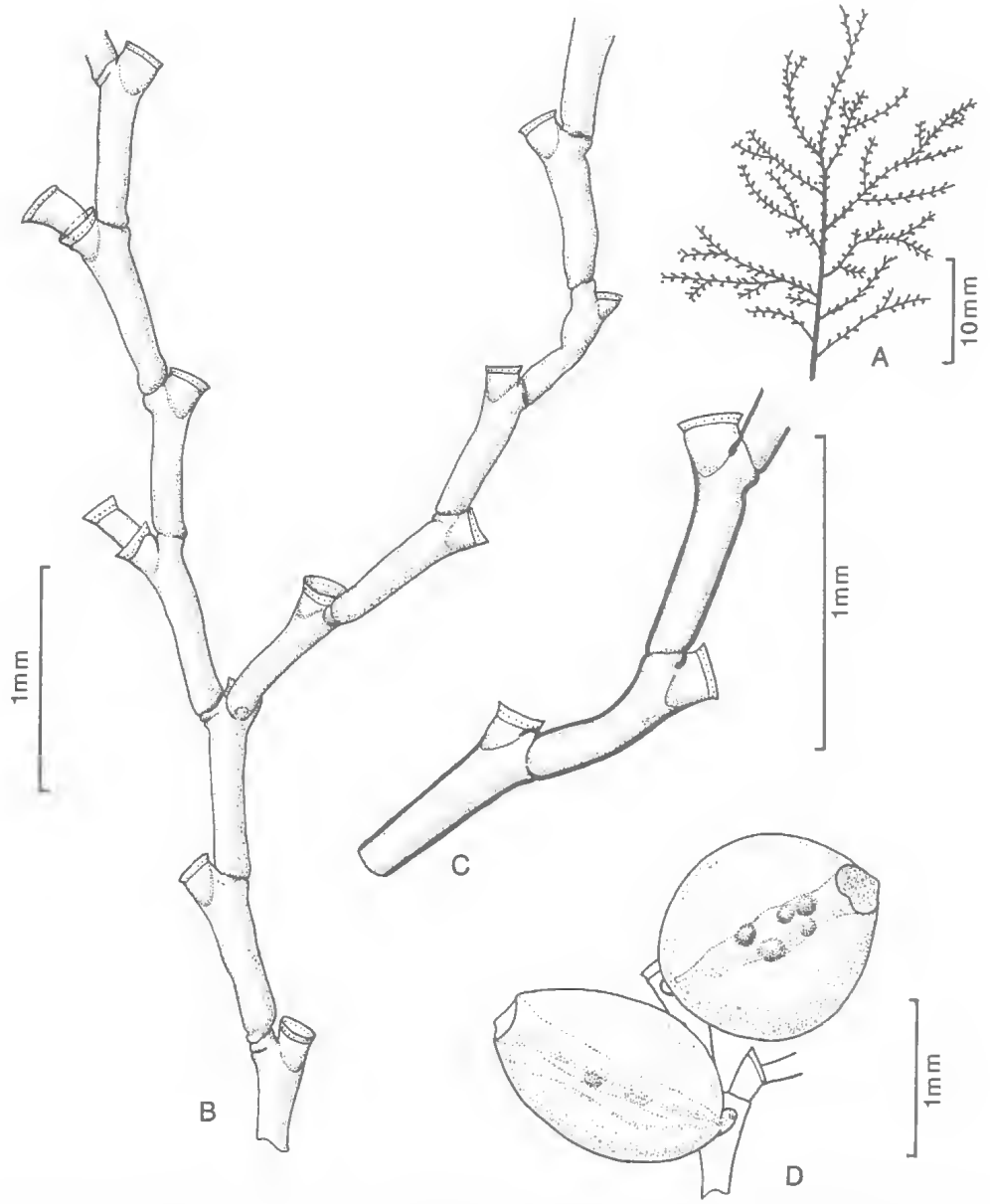


FIG. 8. *Halecium sibogae*. A, habit sketch; B,C, hydrothecae (QM GL10182); D, gonothecae (QM GL10183). Frigate Passage.

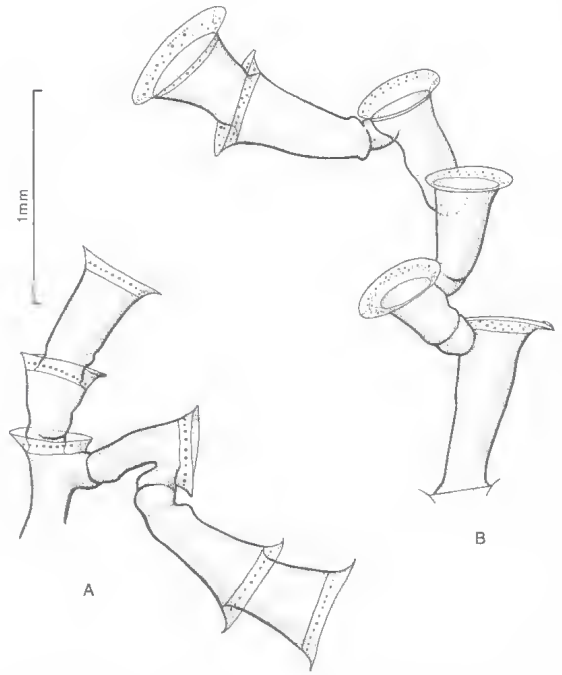


FIG. 9. *Halecium* sp. 1. Joske's reef (QM GL10184).

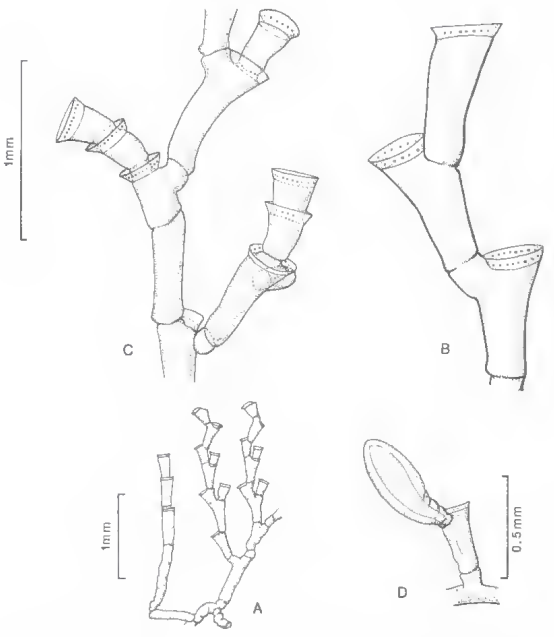


FIG. 10. *Halecium* sp. 2. A, habit; B, hydrothecae (QM GL10185); C, hydrothecae (QM GL10186); D, gonotheca (QM GL10185). Great Astrolabe Reef.

OCCURRENCE IN FIJI

Joske's reef, 18 Sep. 78 (QM GL10184).

Halecium sp. 2 (Fig. 10)

DESCRIPTION

Colony small, rarely >5 mm high; unbranched. Stem monosiphonic; divided into regular thecate internodes by oblique, annulated nodes; each internode with a hydrotheca arising from an apophysis at the distal end; adcauline side of apophyses without thickening. Primary hydrotheca sessile, adcauline wall free from stem. Secondary hydrotheca with a basal constriction, slightly gibbous above and gradually widening distad. Tiers of secondary hydrothecae common. Hydrotheca shallow, with straight sides widening to the margin; margin not everted. Diaphragm straight, with a ring of desmocytes on the hydrotheca above it. Gonothecae on short pedicels, arising singly or in pairs below hydrothecae. Only (probable) male recorded, cylindrical, narrowing proximad, with a small distal aperture.

MEASUREMENTS (μm)

Internode: width 60–90; length 250–390. Hydrotheca: depth 25–35; marginal diameter 110–120. Gonotheca: length 540–570; maximum width 200–230.

REMARKS

The colony form and hydrothecal structure are reminiscent of both *H. beanii* (Johnston) and *H. halecinum* (L.), though the colony size and thecal dimensions in those species are typically much greater than in the present material. The absence of reproductive structures prevents identification.

OCCURRENCE IN FIJI

On coral rock, Suva barrier reef, 7 Jul. 78 (QM GL10185), Great Astrolabe reef, 12 Jul. 80 (QM GL10186).

Hydrodendron Hincks, 1874
Hydrodendron gardineri (Jarvis, 1922)
(Fig. 11)

Halecium gardineri Jarvis, 1922: 334
Hydrodendron gardineri (Jarvis, 1922): Millard 1975: 162

DESCRIPTION

Colony erect, maximum observed height 2.2 mm. Stem monosiphonic and unbranched, divided into internodes of about equal length by trans-

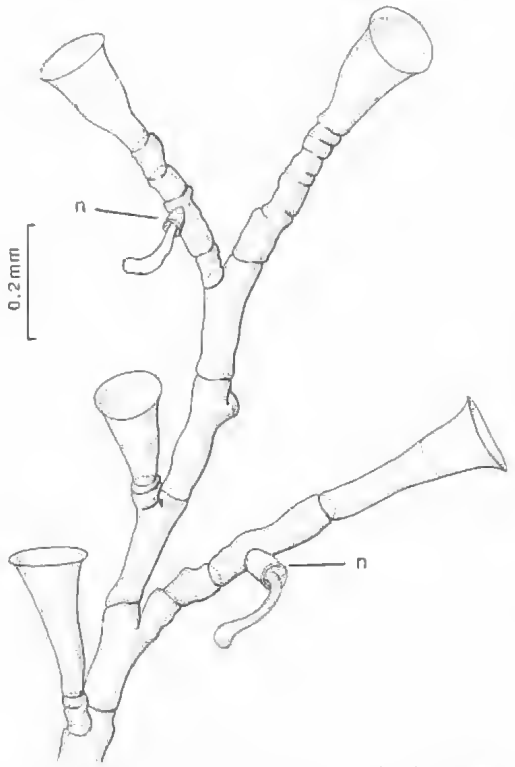


FIG. 11. *Hydrodendron gardineri*. Hydrothecae and nematothecae (n). Suva barrier reef (QM GL10187).

verse or slightly oblique nodes; each internode bearing a single hydrotheca on a distal apophysis of variable length, directed alternately to the left and right, in one plane.

Hydrothecae on short apophyses. These may subsequently be extended into pedicels of variable length which may be divided by transverse septa into segments; corrugated distally. Hydrothecae deep and flaring distad, the margin usually everted. Marginal diameter about one-third of hydrothecal depth. Diaphragm oblique and sloping to the adcauline side. Desmocytes not apparent. Hydranth attached to upper third of hydrotheca.

Nematothecae irregular in occurrence, borne on the hydrorhiza or on internodes of the pedicels, tubular, widening distad, with everted margin. Nematophore with capitulum. Gonothecae not observed (see Jarvis, 1922, and Millard, 1975, for description of male; female unknown).

MEASUREMENTS (μm)

Internode: length 207–600; width 60–87. Hydrotheca: depth 229–340; marginal diameter 136–158. Nematotheca: depth 54–98; marginal diameter 44– 54.

VARIATIONS

Solitary hydrothecae may occur, arising direct from the hydrorhiza, typically on a long, distinctly corrugated pedicel.

REMARKS

Our material is rather fragmentary and, in comparison with that described in other accounts, seems poorly developed. It differs in having neither nematothecae on the stem internodes (though in this it agrees with schizotype, BM 23.2.15.9) nor short athecate internodes scattered irregularly along the stem.

OCCURRENCE IN FIJI

Growing over sponge on dead coral, intertidal flat, Suva barrier reef, 25 Jul. 78 (QM GL10187).

WORLD DISTRIBUTION

Chagos Archipelago (type locality) and Mozambique. The present record constitutes a considerable extension to known range.

Family LAFOEIDAE

Hebella Allman, 1888

Hebella dyssymetra Billard, 1933

(Fig. 12)

Hebella dyssymetra Billard, 1933: 6

DESCRIPTION

Colonies epizoic on certain aglaopheniines;

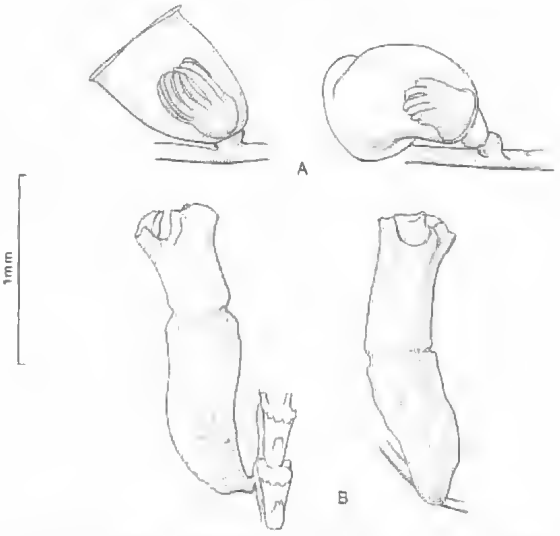


FIG. 12. *Hebella dyssymetra*. A, hydrothecae, Frigate Passage (QM GL10188); B, gonotheca (2 views), on *Lytocarpia phyteuma*, Nukulevu (QM GL10189).

stolonial. Hydrorhiza rounded to flattened, with distinct corrugations; creeping on posterior surface of host stem and under-(athecate) surface of hydrocladia. Hydrothecae arising at irregular intervals, typically asymmetrical and distorted, bending to face forward in relation to the host; shortly pedicellate. Hydrotheca usually 1–1.5 times as deep as wide, campanulate, smooth, delicate; rounded at base, slightly thickened and with a thin, delicate, often indistinct, diaphragm; with slightly everted margin; margin circular, rarely showing signs of renovation. Pedicel with thickened and wrinkled perisarc; it may also bend slightly forward.

Gonotheca almost cylindrical, irregularly corrugated or smooth; truncated distally, tapering basad to a short pedicel; with a 4-valved operculum, loosely fitting and without distinct embayments in rim: aperture distal, squared. Maximum observed number of medusa buds four, arranged one above the other. Colonies in reproductive condition tending to have many irregularly positioned gonothecae but no, or few, hydrothecae.

MEASUREMENTS (μm)

Hydrotheca: marginal diameter 230–280; depth 350–370. Gonotheca: marginal diameter 390–420; depth 1400–1640.

REMARKS

Our material appears referable to var. *trigona* Billard (1942: 68). Though Billard here corrected the spelling of the specific name to *dyssemmetra*, the correction is nomenclaturally not allowable, incorrect orthography not *per se* constituting an 'incorrect original spelling' (Art. 32(c) of the 1985 Code).

OCCURRENCE IN FIJI

On aglaopheniines *Gymnangium hians, Lytocarpia brevirostris* and *L. phyteuma*; windward edge, Great Astrolabe Reef, 26 Jul. 78 and 12 Jul. 80; on *L. phyteuma*, 3–8 m, Frigate Pass, Mbengga barrier reef, 2 Nov. 79 (QM GL10188). Reproductive 27 May 79, Nukulevu (QM GL10189), and 3 Jun. 80, Suva reef (Sta. 25).

WORLD DISTRIBUTION

Red Sea, Seychelles, Malay Archipelago, Great Barrier Reef (Low Is).

Hebella parasitica (Ciamician, 1880)
(Fig. 13)

Lafoea parasitica Ciamician 1880: 673

Hebella parasitica (Ciamician, 1880): Vervoort and Vasseur 1977: 12

DESCRIPTION

Colonies epizoic on halopterine and aglaopheniine hydroids; stolonial. Hydrorhiza slightly rounded to flattened, with few corrugations; creeping on posterior surface of host stem and undersides of hydrocladia. Hydrothecae arising at irregular intervals on pedicels of variable length. Pedicels widening to hydrothecal base, thickened, with a wrinkled perisarc, often spirally twisted. Hydrotheca large, deeply campanulate, 1.5–1.5 times deep as wide, widening distally, smooth or irregularly corrugated; rounded but asymmetrical at base, slightly more thickened on one side than the other, without a distinct diaphragm. Margin strongly everted, circular, often renovated. Gonothecae not observed but have been described, together with the medusa, by Boero (1980).

MEASUREMENTS (μm)

Hydrotheca: depth 640–1200; marginal diameter 400–710; pedicel length 200–560.

REMARKS

This material looks very similar to that illustrated by Vervoort and Vasseur (1977), although ours is considerably larger; however, size is known to be variable in this species.

OCCURRENCE IN FIJI

Recorded on *Antennella secundaria* and *Aglaophenia postdentata*, boulder zone, Suva barrier reef, 27 Apr. 79 and 13 Jun. 79; on *A. postdentata* and *Macrorhynchia philippina* from Ndeumba

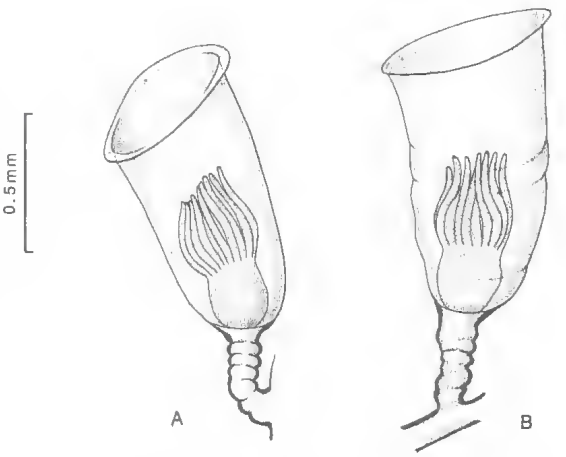


FIG. 13. *Hebella parasitica*. Ndeumba (QM GL10190), on *Macrorhynchia philippina*.

fringing reef, 20 Aug. 78 (QM GL10190) and 18 Mar. 79.

WORLD DISTRIBUTION

Warm water: Mediterranean and eastern Atlantic, Indo-West Pacific to French Polynesia (Vervoort and Vasseur, 1977).

Hebella scandens (Bale, 1888)
(Fig. 14)

Lafoea scandens Bale, 1888: 758
Hebella calcarata (A. Agassiz): Hirohito 1969: 14
Hebella scandens (Bale, 1888): Millard 1975: 182

DESCRIPTION

Colonies epizoic on various sertulariids (see below); stolonial. Hydrotheca shortly pedicellate, cylindrical, with nearly parallel sides slightly constricted below the margin; of variable height, usually 2.5–4 times as deep as wide; smooth or with slightly irregular outline, asymmetrical and upright but often distorted, with the upper half of hydrotheca at an oblique angle to lower (especially noticeable when the colony is epizoic on *Dynamena crisioides* and the hydrotheca curls forward over the hydrotheca of the host); margin circular, slightly everted, invariably oblique and renovated. Annular thickening at the base of the hydrotheca distinct, diaphragm delicate. Pedicel smooth or corrugated, thickened. Gonothecae not observed (but described by Hirohito, 1969 and Millard, 1975).

MEASUREMENTS (μm)

Measurements for 'normal'; 'small'; Veroort and Vasseur (1977); and Mammen (1965) respectively. Hydrotheca: depth 675–850, 340–355, 390–460, 350–370; marginal diameter 150–170, 90–105, 150–160, 140–160.

REMARKS

The Fijian material closely resembles the descriptions and illustrations of previous authors; especially var. *contorta* Marktanner-Turneretscher, 1890, discussed by Vervoort and Vasseur (1977). Normal sized specimens grow on sertulariids and certain other hydroids, notably *Synthecium samauense*. The smallest specimens have dimensions similar to those described in *H. scandens*, but also to *H. thankasseriensis* Mammen, 1965, a species endozoic in *Dynamena thankasseriensis* Mammen, 1965. Some of Mammen's material had hydrothecae, as opposed to a hydrorhiza, that were not enclosed by the host. Millard (1975) has reported an instance in which the stolon of *H. scandens* lay within the perisarc of the host; however, since *H. scandens* has never been reported as truly endozoic, it is probably best to recognize both species.

OCCURRENCE IN FIJI

Found frequently (occurrences in parentheses) on sertulariids collected from reefs in southeast Viti Levu (Suva, Joske's and Ndeumba reefs). Hosts: *Thyroscyphus fruticosus* (4) (QM GL10191), *Dynamena crisioides* (3), *D. cornicina* (1), and *Salacia tetracythara* (1); also present on a sample of *D. crisioides* from London pier, Christmas I. (Line group), 16 Feb. 79. The small specimens came from Ndeumba on *Dynamena quadridentata, Sertularia orthogonalis* n. sp. and *S. ligulata*, 28 Aug. 78 (QM GL10231) and 8 Jul. 79.

WORLD DISTRIBUTION

Nearly cosmopolitan. Type locality, New South Wales.

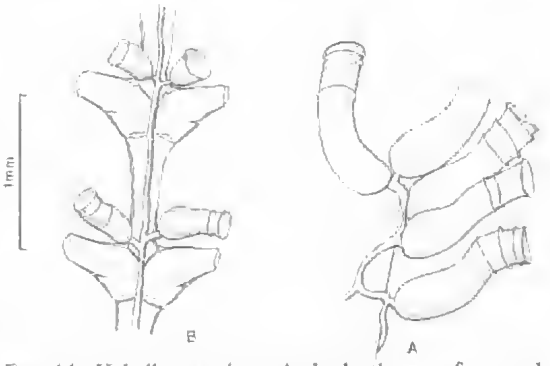


FIG. 14. *Hebella scandens*. A, hydrothecae of normal form, on *Thyroscyphus fruticosus*, Suva barrier reef (QM GL10191); B, small form on *Sertularia orthogonalis* sp.n. Ndeumba (QM GL10231).

Zygophylax Quelch, 1885
Zygophylax rufa (Bale, 1884)
(Fig. 15)

Campanularia rufa Bale, 1884: 54
Lictorella rufa (Bale, 1884): Vervoort and Vasseur 1977: 15
Zygophylax rufa (Bale, 1884): Rees and Vervoort 1987: 55

DESCRIPTION

Colonies pinnate, stems and hydrocladia in one plane; reaching 50 mm. Stems polysiphonic, slightly geniculate distally, branching at the base;

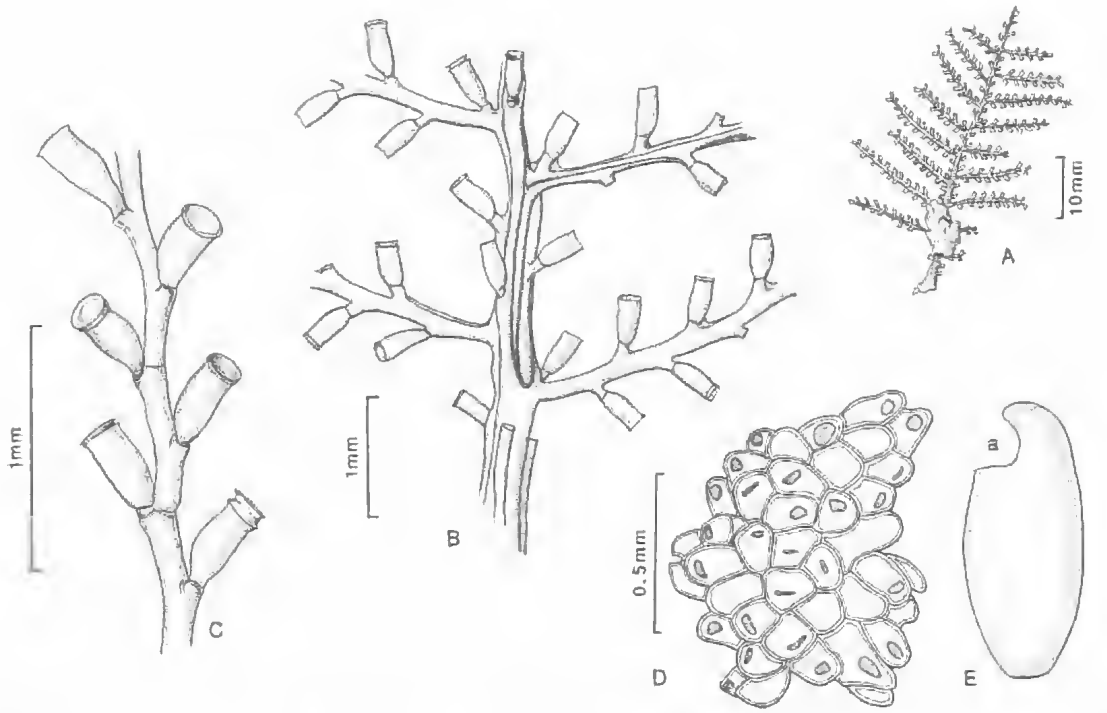


FIG. 15. *Zygophylax rufa*. A, habit sketch; B, part of stem with hydrocladia; C, part of hydrocladium (B, C, QM GL10193); D, coppinia; E, single gonotheca in profile, its aperture (a) at top left. (D, E, QM GL10194). Ndeumba.

giving off hydrocladia and hydrothecae alternately from the axial tube. Hydrocladia at a wide angle to the stem, arising below every second or third cauline hydrotheca (the apparently axillary hydrotheca being on the hydrocladium); typically lightly polysiphonic basally and monosiphonic distally; generally without nodes.

Hydrocladia bearing alternate, antero-lateral hydrothecae on short apophyses, each separated from hydrothecal pedicel by a partial node. Pedicel short and slightly more slender than the apophysis. Hydrotheca deeply campanulate, narrowing to apophysis, with adcauline wall slightly convex and abcauline wall nearly straight; widening to smooth, everted margin; often renovated, sometimes unequally. Walls thickened. Diaphragm distinct, transverse.

Nematotheca tubular, short; probably caducous; one present at the hydrocladial base, near the axillary hydrotheca or, more commonly, a small perisarcal pore in this position. Also found occasionally on apophysis or pedicel of cauline hydrothecae.

Coppinia on the front of a stem at the colony base. Constituent gonothecae polygonal (5- or 6-merous) in cross-section; narrowed proximally and rounded distally, with a small, hooded, distolateral aperture. Stem a mahogany colour, hydrothecae yellowish.

MEASUREMENTS (μm)

Hydrotheca: depth 290–390; marginal diameter 130–155; diaphragm diameter 50–95; pedicel length 40–85.

VARIATIONS

Large colonies common on coral rock, small ones occasionally found epizoic on *Macrorhynchia phoenicea*. Hydrocladia may have irregular transverse nodes. Cauline hydrothecae at the colony base are arranged irregularly, not in one plane; and they arise from both axial and peripheral tubes. The hydrothecae often appear sessile, since the base merges directly with the apophysis (see also fig. 7 in Vervoort and Vasseur, 1977).

REMARKS

This species has been well redescribed by Vervoort and Vasseur (1977). The coppiniae in our colonies are not split into upper and lower sections but form one complete mass covering the front, and sometimes the back, of the stem; all parts contained reproductive products. In a recent review of species, Rees and Vervoort (1987)

concluded that the nominal genus *Lictorella* should not be retained separate from *Zygophylax*.

OCCURRENCE IN FIJI

Widely distributed at LWST and in shallow water: Suva barrier (BM 1984.5.17.13), Joske's, Ndeumba fringing (QM GL10193), Great Astrolabe, and Mbengga barrier reefs (BM 1984.5.17.11, 11a): with coppiniae, Ndeumba, 20 Aug. 78 (BM 1984.5.17.12; QM GL10194).

WORLD DISTRIBUTION

Torres Strait, Great Barrier Reef (Holbourne I.), and French Polynesia (Tuamoto archipelago).

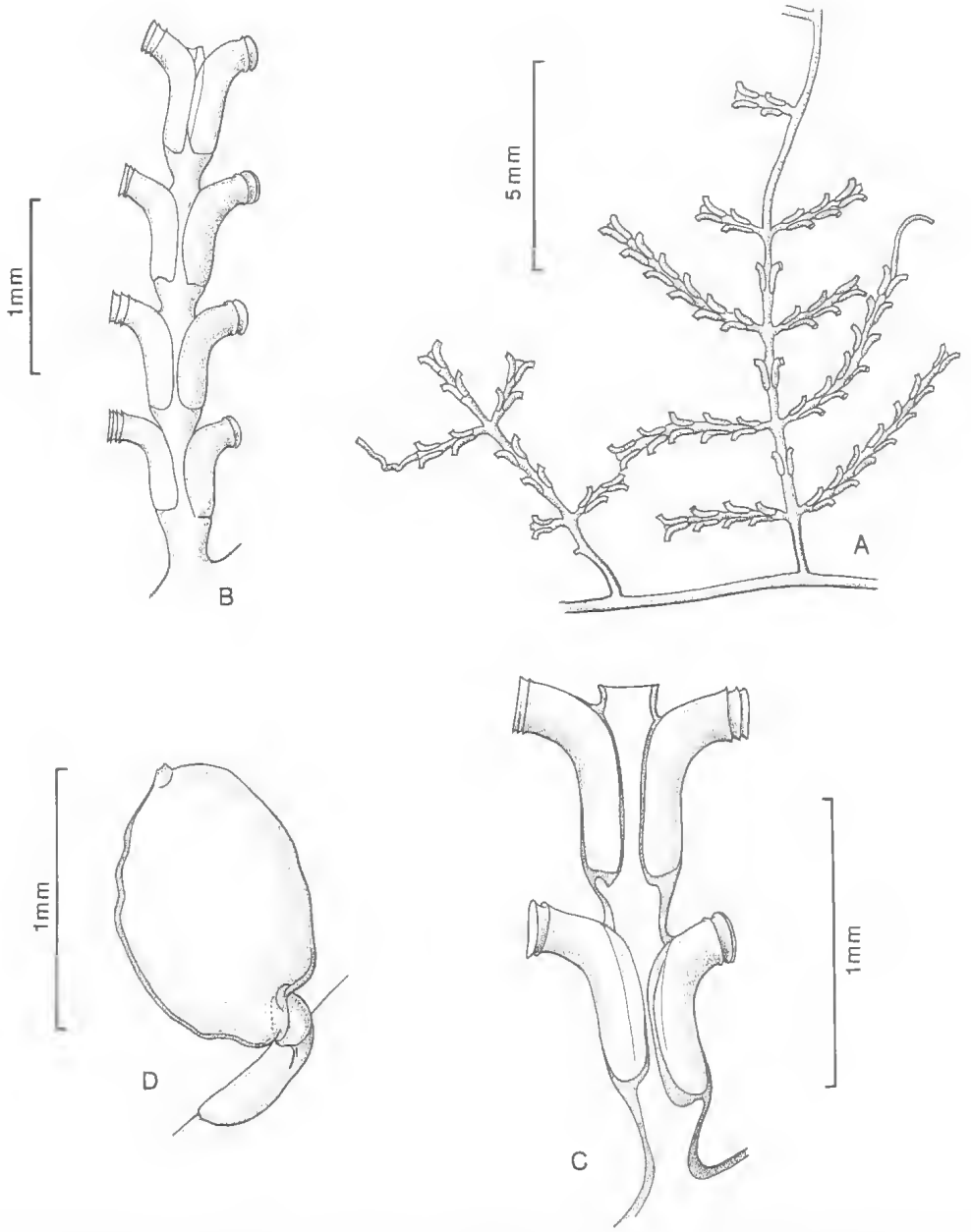


FIG. 16. *Synthecium samauense*. A, erect stems; B, C, hydrothecae (QM GL10196); D, gonotheca (QM GL10195). Great Astrolabe Reef.

Family SYNTHECIIDAE
Synthecium Allman, 1872

Synthecium was introduced by Allman on p. 229 of his monograph, the publication dates of which (1871–72) do not correspond with the division of the work into two parts. The first instalment of Part I — *The Hydroida in general*, was published in 1871 and the residue (p. 155–231) in 1872 together with Part II — *The genera and species of the Gymnoblastea*.

Synthecium samauense Billard, 1924
(Fig. 16)

Synthecium samauense Billard, 1924: 646
S. samauense: Billard 1925: 132

DESCRIPTION

Stems erect, monosiphonic; reaching 20 mm; arising from hydrorhiza. Hydrocladia pinnately arranged, in one plane. Stem divided by indistinct 'nodes' into internodes of variable length, each with a pair of opposite hydrocladia distally and up to two pairs of opposite hydrothecae proximally. Basalmost internode either without hydrocladia and hydrothecae or with hydrocladia but without hydrothecae: terminated by a transverse node.

Hydrocladia unsegmented, often terminating in a tendril-like extension of variable length; this resembles and may fuse with the hydrorhiza, giving rise to irregularly-spaced solitary hydrocladia. Hydrothecae arranged in opposite to subopposite pairs: members of a pair typically separated in proximal part of stem, both in front and behind, grading distally to pairs being contiguous in front. Consecutive hydrothecae not overlapping. Hydrothecae smooth, tubular, not widening to the margin; adnate for about four-fifths of their vertical height, curving abruptly outwards at 60–70° to the hydrocladial axis. Abcauline wall thickened and nearly parallel with the hydrocladial axis in its lower part, but with a slight basal swelling. Length of free portion variable; margin without cusps, everted and invariably renovated; perisarc in the axil thickened.

Gonotheca arising from within hydrotheca, smooth, pedicellate; asymmetrically ovate, flattened in one plane. Wall thickened, with small distal aperture on short conical collar.

VARIATIONS

Colonies have either large or small hydrothecae (see 'Measurements'). The nodes are more apparent than real, being produced by stem renovation.

MEASUREMENTS (μm)

Measurements for 'large' and 'small' respectively. Hydrotheca: adnate length 520–610, 400–440; free adcauline length 210–390, 200–270, marginal diameter 160–210, 130–150. Distance between hydrothecae: 150–240, 130–280. Diameter across thecal pair: 330–370, 260–310. Gonotheca (female): length 990–1200 ('large'); maximum width (2 only) 774 ('large').

REMARKS

Our material agrees closely with Billard's (1925) and Vervoort and Vasseur's (1977) descriptions, the Fijian material similarly having hydrothecae of two sizes. The fertile female colonies all had hydrothecae of the larger size, though whether this represents sexual dimorphism we cannot say: none of the smaller specimens was fertile.

OCCURRENCE IN FIJI

Found on coral rock: Thangilai reef edge, 28 Apr. 79; Joske's reef, reproductive, 18 Sep. 78 (BM 1984.5.17.14); windward Great Astrolabe reef, 24 Jul. 78 (QM GL10196), reproductive (BM 1984.5.17.15; QM GL10195), and 12 Jul. 80.

WORLD DISTRIBUTION

Semau I., Timor, Indonesia (type locality); New Caledonia and French Polynesia.

Family CAMPANULARIIDAE
Clytia Lamouroux, 1812
Clytia edentula sp. nov.
(Fig. 17)

MATERIAL EXAMINED

HOLOTYPE: Slides (QM GL10197/8) collected 13 Dec. 1978.

PARATYPES: Slide (BM 1988.11.11.1), and preserved specimens (BM 1984.5.17.9), also from the type locality, 13 Dec. 1978.

TYPE LOCALITY: Ndeumba fringing reef, Pacific Harbour, Viti Levu; on *Sargassum*, 13 Dec. 78 (reproductive).

DERIVATION OF NAME

L., *edentulus*, toothless; referring to the rim of the hydrotheca.

DESCRIPTION

Colony stolonial, with anastomoses. Pedicels unbranched; of variable height, 1.2–2.9 mm; closely annulated at base, mid-region smooth, distally with corrugations terminating in a moniliform series of up to four flattened vesicles.

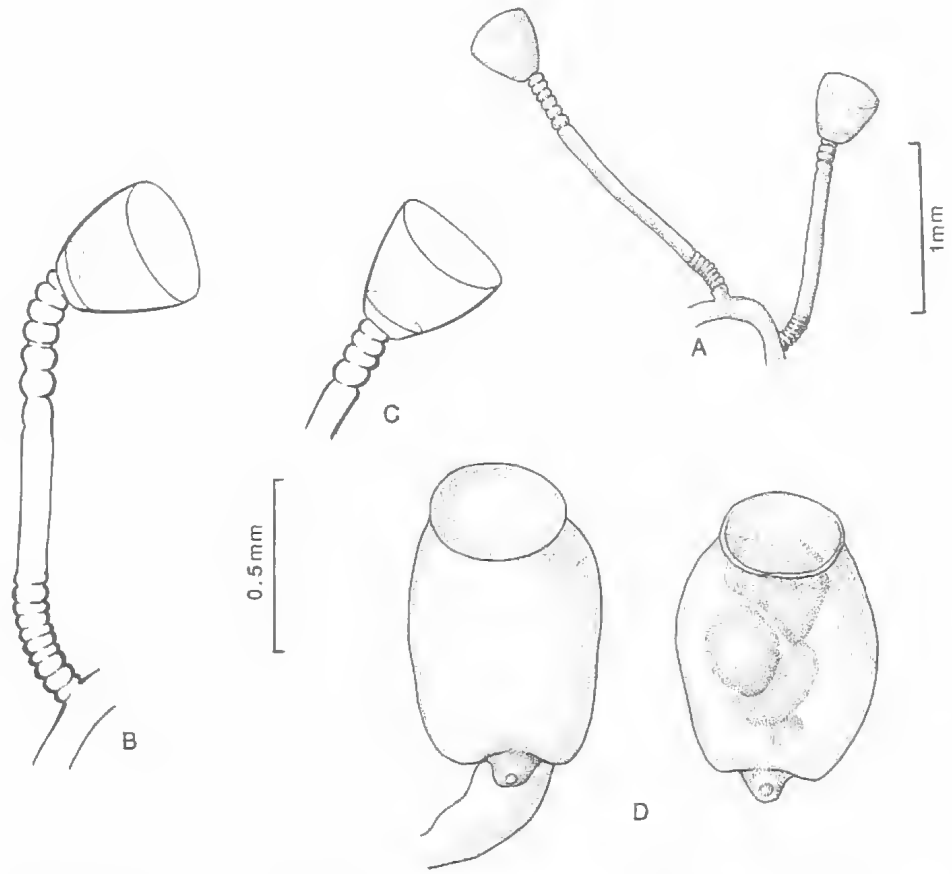


FIG. 17. *Clytia edentula* sp.n. Holotype. A-C, hydrothecae; D, gonothecae. Ndeumba (QM GL10197, 10198).

Hydrotheca obconical, with straight, unthickened walls; depth about equal to diameter; margin smooth, or sometimes with 6–8 indistinct, flat and rounded cusps; diaphragm delicate, distinct, transverse and separating off a shallow, broad basal chamber; ring of large refringent desmocytes above diaphragm (as in Haleciidae), prominent in empty hydrothecae; often with a thickened perisarcal annulus at the diaphragm, as in *C. simplex* Congdon, 1907.

Gonotheca arising directly from hydrorhiza; smooth, ovoid-spherical with truncated base which constricts sharply to short, curved pedicel; wide aperture on short collar.

MEASUREMENTS (μm)

Hydrotheca: depth 350–450; marginal diameter 300–450. Gonotheca: length 780–830; marginal diameter 350–370, maximum width 600–630.

VARIATIONS

The number of vesicles immediately below the hydrotheca varies from one to four, making it difficult to regard the terminal one as a sub-hydrothecal spherule as defined by Cornelius (1982), mostly in the Campanulariinae; the extent of corrugation below them also variable. The mid-region of the pedicel may be corrugated.

REMARKS

The lack of prominent marginal cusps is a feature shared with *C. hummelincki* (Leloup, 1935), *Orthopyxis integra* (Macgillivray, 1842), and *O. crenata* (Hartlaub, 1901b). In comparison with the present species, these have much less annulation of the pedicel, and the gonothecae are markedly different. Furthermore, species of *Orthopyxis* L. Agassiz, 1862, are characterized by presence of a sub-hydrothecal spherule and absence of a diaphragm (Cornelius, 1982). Using these criteria, therefore, despite the superficial similarity, the present species should not be referred to *Orthopyxis*. The gonothecae in our material do not clearly show the formation of

medusae but the wide aperture suggests that free medusae are released.

OCCURRENCE IN FIJI

Type locality only.

Clytia (?)gracilis (M. Sars, 1850)
(Fig. 18)

Laomedea gracilis M. Sars, 1850: 138
C. sarsi Cornelius, 1982: 78 [nom. nov. pro *Laomedea gracilis* Sars, non Dana]
C. hemisphaerica (L., 1767) f. *gracilis* (*sensu* M. Sars, 1851): Östman, 1983
C. gracilis (Sars, 1850): Cornelius and Östman, 1986: 165 [proposed nomen conservandum]

DESCRIPTION

Pedicels unbranched, 1.0–1.5 mm high, closely annulated at the base, and with up to three flattish annulations distally. Hydrotheca campanulate, expanding to the margin, height 1.5–2.0 times top diameter. Margin with 10–12 pointed, oblique cusps. Diaphragm delicate but not thin; transverse, separating off a broad, shallow basal chamber. Gonotheca borne on the hydrorhiza, on pedicel of up to three annulations; smooth, elongate, tapering proximad, truncated distally; aperture distal, broad, above a slight constriction.

VARIATIONS AND REMARKS

Although this material closely resembles the original illustration of *C. obliqua* Clarke, 1907, and the subsequent drawings of Fraser (1936), Picard (1950) and Hirohito (1969), examination of type material (Smithsonian Institution No. 29616) from Perico Island (Gulf of Panama) brings us to agree with Cornelius (1982) that *C. obliqua* is conspecific with *C. linearis* (Thornely, 1899). The type colonies are branched and the hydrothecae tall. While it was not possible to observe the characteristic stiffening strips (see *C. linearis*), the non-oblique cusps are certainly more like those of *C. linearis* than our material.

Oblique hydrothecal cusps are a characteristic feature of *C. gracilis* Sars, 1850 (= *C. sarsi* Cornelius, 1982) and probably also of *C. pelagica* van Breemen, 1905. However, in contrast to the illustration of this species (as *C. hemisphaerica* f. *gracilis*) by Östman (1983, Pl. 3, fig. 5), the diaphragm in our specimens is relatively thick and more akin to Östman's (1983, Pl. 2, fig. 3) *C. h. johnstoni* (Alder, 1856). The thickness of the diaphragm is, however, apparently variable in both taxa and cannot be used with certainty to dis-

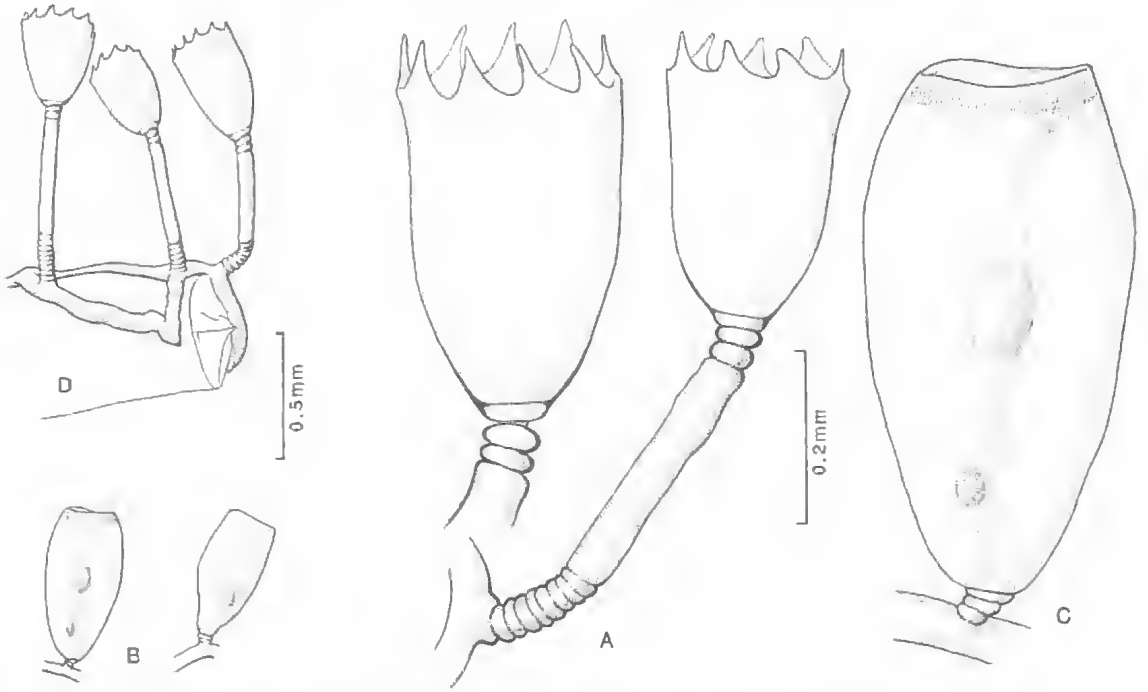


FIG. 18. *Clytia ?gracilis*. A, hydrothecae, Nukumbutho reef; B,C, gonothecae; D, habit sketch: part of colony growing on hydrotheca of *Thyroscyphus fruticosus*, Suva Barrier Reef (QM GL10199).

tinguish one from the other. Smooth gonothecae have traditionally been associated with *gracilis* (e.g., Vervoort, 1968; Millard, 1975; Östman, 1983), ribbed gonothecae with *johnstoni* (e.g., Pennycuik, 1959; Millard, 1975; Östman, 1983). Ralph (1957), however, described New Zealand *johnstoni* with variably ribbed gonothecae. Acute, oblique hydrothecal cusps are characteristic of *gracilis*, rounded and non-oblique cusps of *johnstoni* (see Millard, 1975; Östman, 1983), though Vervoort's (1968) illustration of *C. pelagica* (= *C. gracilis*) shows rounded, non-oblique cusps. Examination of the South African Museum's '*C. hemisphaerica*' reveals variations in both of these supposedly distinguishing characters, such that existing concepts of the distinctions between the morphology of the two taxa become blurred. Vervoort (1959, 1968, 1972) maintained that the hydrothecae of *gracilis* have a unique, undulating cross section, noted also by Millard (1975), but this character was not observed in the Fijian specimens.

The status of these taxa has been very confused (see Cornelius, 1982). Vervoort (1959, 1968, 1972) regarded *C. hemisphaerica* and *C. gracilis* as separate species. So now do Cornelius and Östman (1986), on the grounds of nematocyst structure and differences between the hydranths, medusae and life cycles. Millard (1975) treated them as forms of one species.

Records of '*C. johnstoni*' are common from tropical and temperate waters. Those of *C. gracilis* tend to be concentrated around northern European waters though records, under various names, exist from the Atlantic coast of the Americas (Fraser, 1944; Vervoort, 1972), the Caribbean (Deevey, 1954; Vervoort, 1968), West Africa (Vervoort, 1959), South Pacific (Hartlaub, 1905), eastern Pacific (Fraser, 1948), and India (Mammen, 1965). Taking such records at face value, there is no reason why *gracilis* should not occur around Fiji.

Unfortunately, we cannot investigate the nematocysts and allozymes of our preserved material

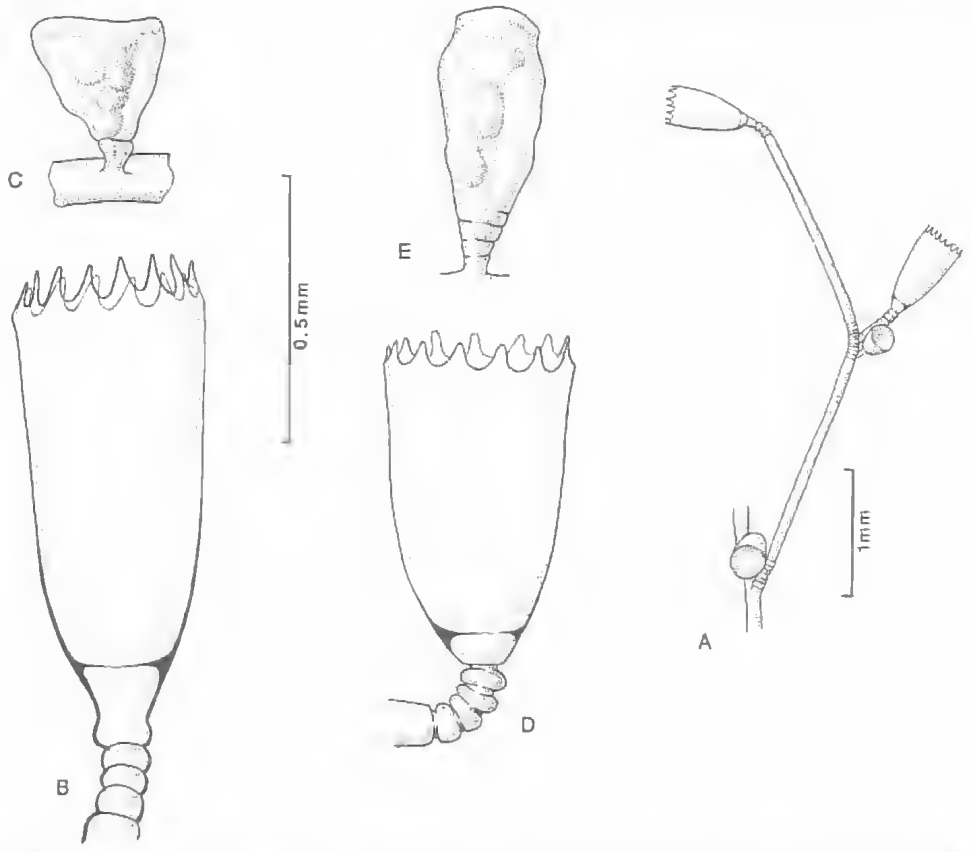


FIG. 19. *Clytia hemisphaerica* f. *johnstoni*. A, part of colony showing sympodial branching; B, hydrotheca; C, gonotheca (? partly developed) (A-C, QM GL10200, Mba); D, hydrotheca; E, gonotheca (both from QM GL10201, with unbranched pedicels, Suva Barrier Reef).

(*cf.* Östman, 1979, 1982), so our attribution to *C. gracilis* is tentative. That the number of described *Clytia* ('*Phialidium*') nominal medusa species overall exceeds the accepted number of hydroid species (P.F.S. Cornelius, *pers. comm.*), and that Bouillon (1984) has recorded eight *Clytia* medusa species from the Bismarck Sea compared with our four hydroid species from Fiji, are indicative of the work still to be done on this genus.

MEASUREMENTS (μm)

Hydrotheca: depth 430–500; marginal diameter 200–250. Gonotheca: length 550–600; marginal diameter 180–240.

OCCURRENCE IN FIJI

On *Thyroscyphus fruticosus* (sand population) on the reef flat near Nukumbutho Pass, 23 Sep. 79 (QM GL10199).

Clytia hemisphaerica (Linnaeus, 1767)
(Figs. 19–21)

Medusa hemisphaerica Linnaeus, 1767: 1098
Epenthesis folleatum McCrady, 1857: 191 [medusa]
Clytia Johnstoni Alder: Hincks 1868: 143
Clytia hemisphaerica (Linnaeus, 1767): Millard 1975: 217; Cornelius 1982: 73; (cum part. syn.); Cornelius and Östman 1986: 164.

DESCRIPTION

Colony stolonial to shortly erect. Pedicels typically simple, though occasionally with one sympodial branch; of variable height up to 6 mm;

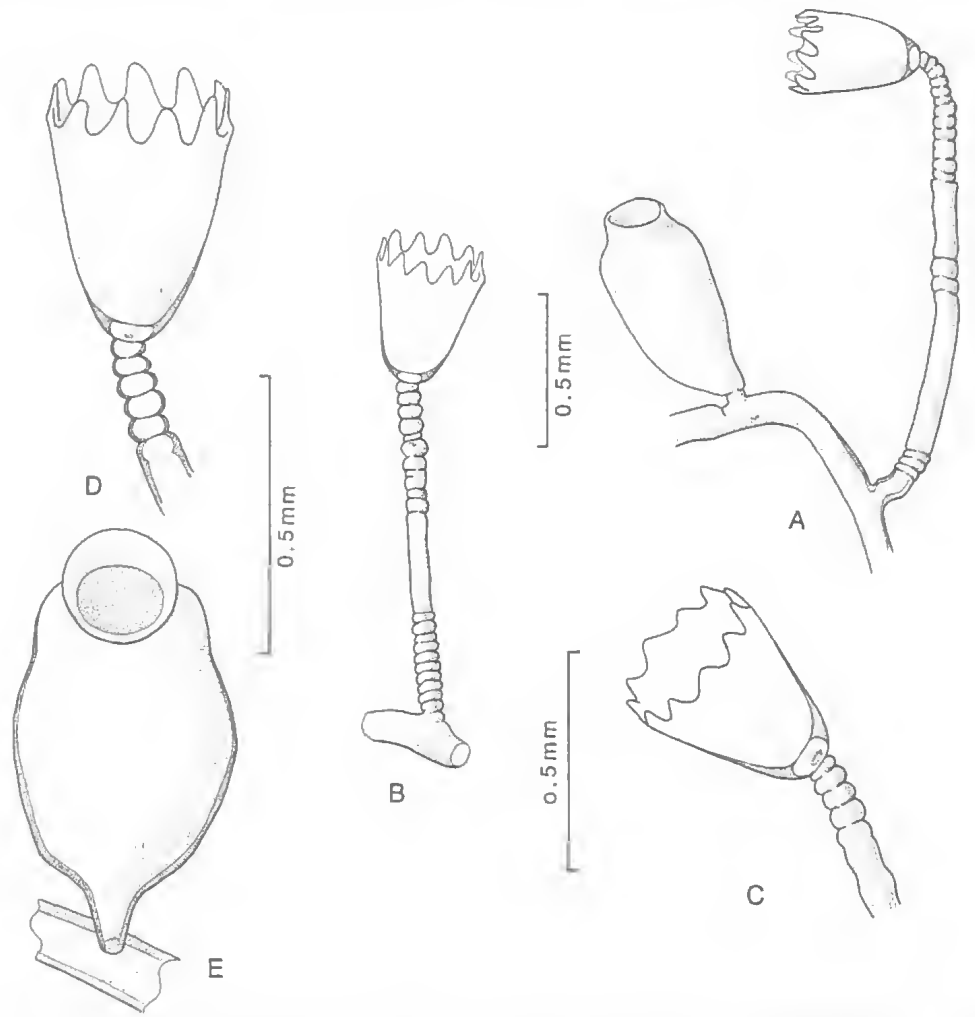


FIG. 20. *Clytia hemisphaerica* f. *folleata*. A, part of stolon with hydrotheca and gonotheca; B,C,D, hydrothecae showing various amounts of annulation; E, gonotheca. QM GL10202, Ndeumba.

closely annulated proximally and distally, smooth in mid-region (see Fig. 19).

Hydrotheca deeply campanulate, expanding little to margin; depth usually 2–3 times diameter. Margin with 10–18 cusps; these tall, distinctly pointed; often with short but distinct longitudinal ridge at base of the rounded bays. Diaphragm delicate, distinct, transverse or slightly oblique, separating off a bell-shaped basal chamber. Thecal walls typically unthickened.

Gonotheca borne on hydrorhiza and, if the colony is erect and branched, also on the pedicel, just above its origin from the stem. Variable in shape, usually elongate-ovoid, tapering slightly proximad and truncated distally; on a short annulated pedicel. Aperture distal, wide; often a variably distinct constriction below, giving the impression of a collar.

Variations and Remarks

This is recognized as an exceptionally variable species (Cornelius, 1982) and the material from Fiji is no exception. The mid-region of the pedicel may be irregularly annulated or corrugated. The diaphragm is at an inconstant distance from the hydrothecal base, and the basal chamber of correspondingly variable shape. The marginal cusps vary in both number and shape.

The above colonies, following the account of Östman (1983), we refer to f. *johnstoni*. Specimens from Ndeumba (13 Dec. 78 on red algae; Fig. 20) are very different, having obconical hydrothecae which are distinctly thickened at the diaphragm, much as in the manner of *Campanularia* sp., except that the thickening is double, the perisarcal ring being a later addition. The hydrothecal pedicel terminates in up to five flattened vesicles. The gonotheca, borne on a non-annulated pedicel, is smooth, elongate, tapering proximad and rounded distally; and its aperture is on a distinct collar. This (Ndeumba) material resembles more closely the illustrations of *C. simplex* Congdon, 1907, and *C. folleata* (McCrady) in Vannucci (1946) than those of nominal *C. hemisphaerica*. However, *C. simplex* has been regarded conspecific first with *C. noliformis* McCrady by Fraser (1944) and subsequently with *C. hemisphaerica* (by Cornelius, 1982, who included a lengthy taxonomic discussion). Schmidt and Benović (1977) regarded *C. folleata* as an aberrant form of *C. hemisphaerica*, though Cornelius (1982) opined that more material was necessary before this could be substantiated. Following Östman (1983), we distinguish this as f. *folleata*.

In a second variant found around Fiji (Fig. 21) the hydrothecae abruptly reach their full width just above the diaphragm. Thereafter the walls are straight and more or less parallel; the margin is slightly flared, with eight pointed cusps. This variation was observed twice, once as part of an elsewhere normal f. *johnstoni* colony.

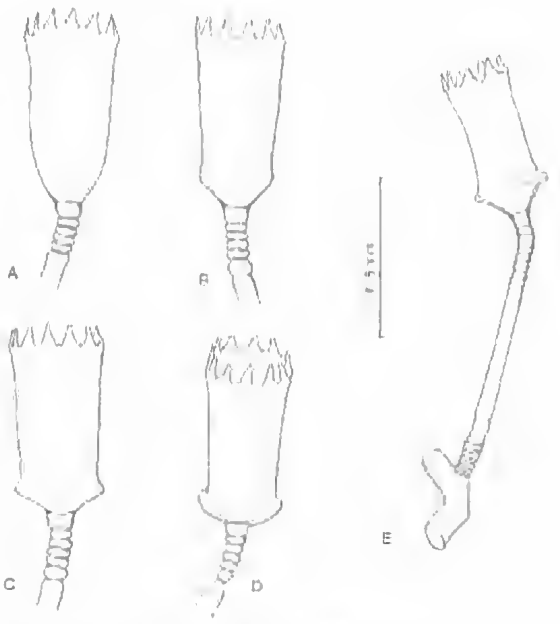


FIG. 21. *Clytia hemisphaerica*, aberrant forms. A-D, four hydrothecae showing range in form within one colony; QM GL10203, Mba; E, hydrotheca; QM GL10204, Ndeumba.

Measurements (μm)

Measurements for f. *johnstoni*; f. *folleata*; and aberrant form respectively. Hydrotheca: depth 400–900, 350–450, 510–620; marginal diameter 200–350, 250–300, 170–210; diameter at basal ridge —, —, 210–240. Gonotheca: length 340–1000, 550–770, —; marginal diameter 140–250, 180–240, —; maximum width 170–280, 350–410, —.

Occurrence in Fiji

Forma *johnstoni*: On sea grass (*Halodule pinifolia*), intertidal sand flats, Suva Point, March 1978 (BM 1984.5.17.8; QM GL10201); on *Dynamena crisioides*, Suva barrier reef, 11 Apr. 78, on *Gracilaria* sp., intertidal sand flats, mouth of Mba river, 9 Nov. 78 (reproductive)(BM 1984.5.17.7; QM GL10200); on *Sargassum* sp., 7 May 78 (reproductive); on *Lytocarpia phyteuma*, windward Great Astrolabe Reef, 12 Jul. 80. Also on *D. crisioides* from London pier, Christmas I.

(Line group), 16 Feb. 79. Forma *folleata*: on red algae, 13 Dec. 78, Ndeumba fringing reef (BM 1984.5.17.6; QM GL10202).

WORLD DISTRIBUTION

Nearly cosmopolitan in coastal waters.

Clytia linearis (Thornely, 1899)
(Fig. 22)

Obelia linearis Thornely, 1899: 453
Campanularia gravieri Billard, 1904: 482
Campanularia(?) *obliqua* Clarke, 1907: 9
Clytia gravieri (Billard, 1904): Millard and Bouillon 1973: 51; Millard 1975: 215
Clytia linearis (Thornely, 1899): Cornelius 1982: 84 (cum syn.)

DESCRIPTION

Colonies stolonial, with erect sympodia; monosiphonic (but sometimes thickened at base), to 9 mm; pedicels with 4–6 close annulations at base and at origin of branches, but with a variable number distally, always extending for a distance greater than the hydrothecal depth. Branches upwards directed, parallel with the stem.

Hydrotheca deeply campanulate, expanding slightly to margin, delicate, often with straight abcauline wall and slightly convex adcauline one. Depth usually 1.5–2 times diameter. Margin with 10–12 pointed cusps of variable length, each with a distinct 'keel' or stiffening strip, visible as a longitudinal ridge extending from the cusp tip a short way down the theca. Cusps separated by rounded bays. Diaphragm delicate, distinct; transverse or slightly oblique.

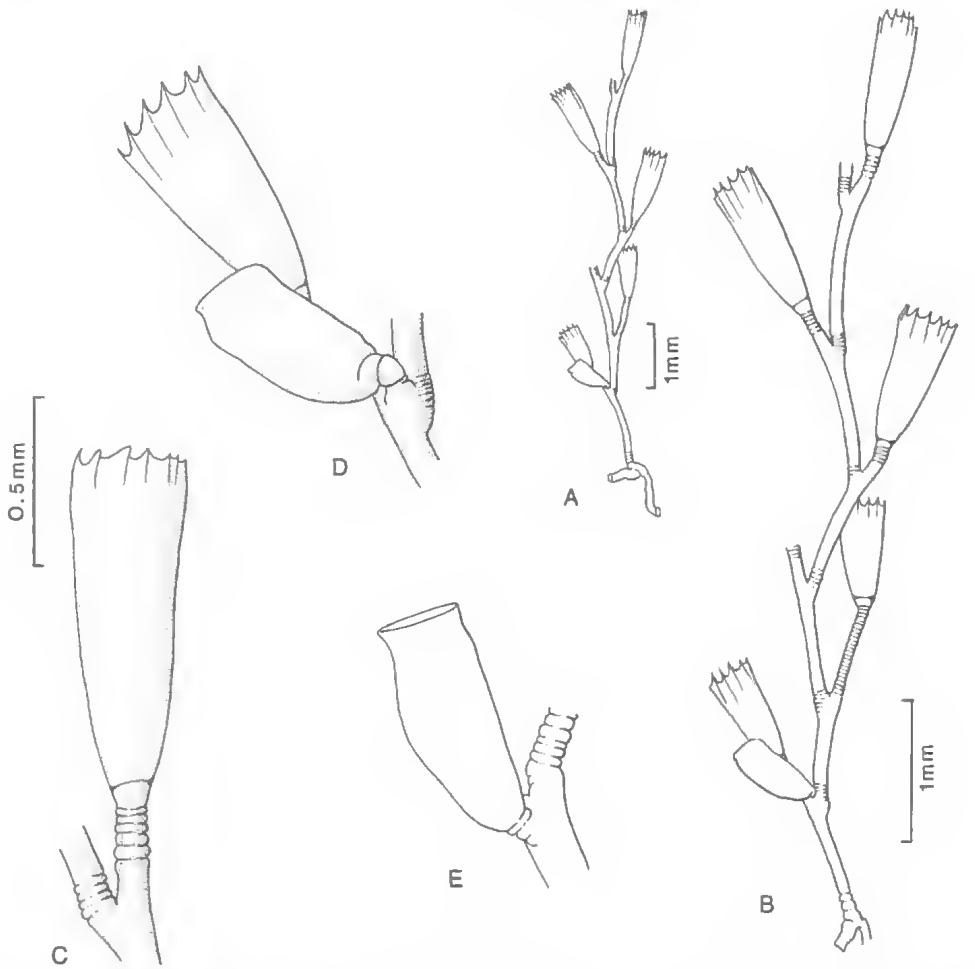


FIG. 22. *Clytia linearis* (QM GL10205). A, B, part of sympodium; C, hydrotheca; D, hydrotheca and gonotheca; E, gonotheca. Suva Barrier reef.

Gonotheca borne at base of hydrothecal pedicel; on a short, annulated pedicel; smooth, tapering proximad and truncated distally.

MEASUREMENTS (μm)

Hydrotheca: depth 550–700; marginal diameter 300–400. Gonotheca: length 600; marginal diameter 170; maximum diameter 280.

VARIATIONS

Occasional second order, sympodial branches may be present (Fig. 22). Marginal renovation common. Annulations below hydrothecae rarely interrupted by a smooth mid-region.

OCCURRENCE IN FIJI

Thangilai reef, 28 Apr. 78 (reproductive); Suva barrier reef, boulder zone, 27 Apr. 79 (QM GL10205); forereef west of Suva Point, 0–20 m, 19 Feb. 80; all on coral rock.

WORLD DISTRIBUTION

Tropical, subtropical and warm temperate oceans.

Obelia Péron and Lesueur, 1810
Obelia bidentata Clarke, 1875
(Fig. 23)

Obelia bidentata Clarke, 1875: 58
Obelia bidentata Clarke, 1875: Cornelius 1975: 260 (cum syn.)

DESCRIPTION

Colonies erect; stems monosiphonic, unbranched; slightly geniculate in younger regions only; reaching 11 mm. Hydrothecae alternate, sympodial. Internodes of variable thickness, with four or more annulations at the proximal end and bearing hydrotheca on short apophysis distally. Pedicel short, typically less than half hydrothecal depth; closely annulated throughout.

Hydrotheca elongate-campanulate, circular in cross section, delicate. Depth 2.5–3 times diameter. Margin with 10–14 bimucronate cusps; 'keel' absent. Diaphragm delicate, indistinct; transverse or slightly oblique.

Gonotheca arising either in axil of hydrothecal pedicel or directly from hydrorhiza; supported by

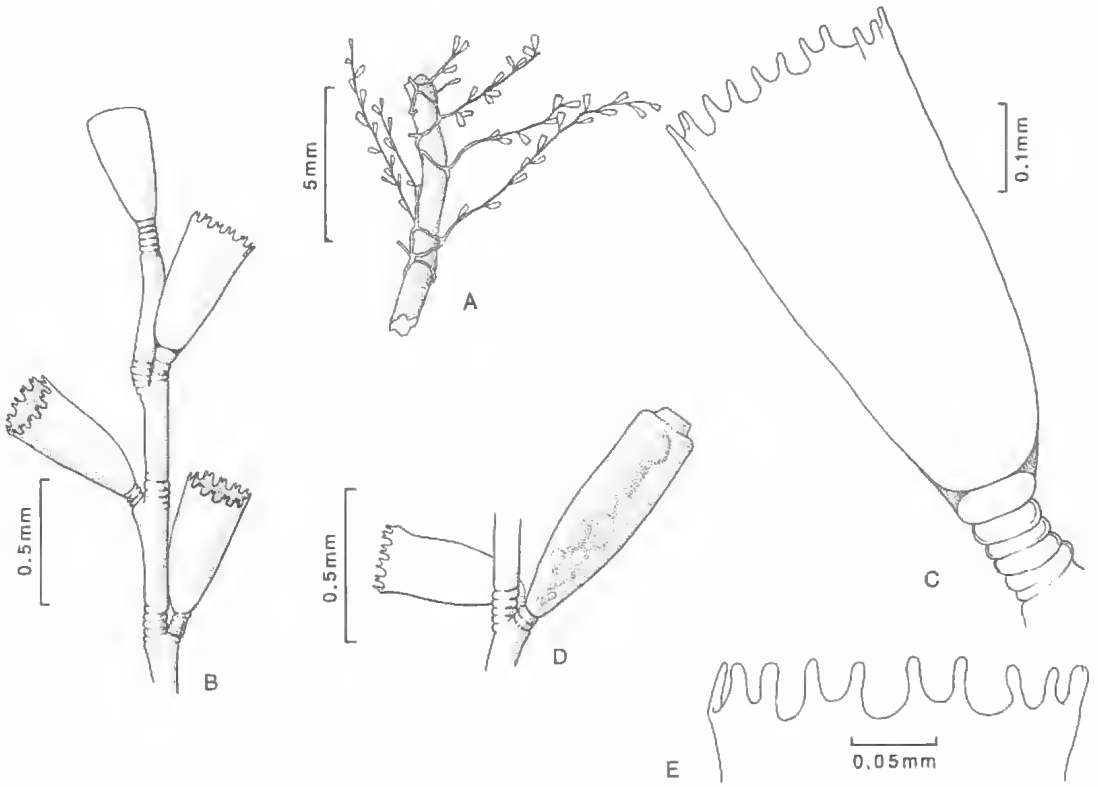


FIG. 23. *Obelia bidentata* (QM GL10206, 10241). A, part of colony growing on *Gracilaria*; B, portion of stem; C, hydrotheca; D, gonotheca; E, rim of hydrotheca showing bicuspid teeth. Mba.

short, annulated pedicels; smooth, elongated, tapering proximad and truncated distally. Aperture borne on a short but distinct collar.

MEASUREMENTS (μm)

Hydrotheca: depth 550–650; marginal diameter 220–280. Gonotheca: length 640–870; marginal diameter 90–120; widest diameter 190–240.

VARIATIONS

The hydrothecal pedicel is variable in length, usually, though not always, less than half the thecal depth. Some hydrothecae have slightly keeled cusps and several longitudinal ridges.

REMARKS

Our material resembles *O. oxydentata* Stechow, 1914, as illustrated by Hirohito (1969), later referred to *O. bidentata* by Cornelius (1982). The gonothecal aperture is on a distinct collar, the hydrothecal pedicels are relatively short, and the colony shows little branching. Although these are characters displayed by *O. oxydentata* they fall within the range of variation of *O. bidentata* (Cornelius, 1975 and pers. comm.)

OCCURRENCE IN FIJI

On *Gracilaria*, intertidal sand flats near mouth of Mba river, 9 Nov. 78 (reproductive)(BM 1984.5.17.10; QM GL10206).

WORLD DISTRIBUTION

Widespread in temperate to tropical seas.

Campanularia Lamarck, 1816
Campanularia sp. (Fig. 24)

DESCRIPTION

Colony stolonial. Pedicels unbranched, variable in height, reaching 2.4 mm; corrugation variable throughout, but bearing distally a depressed spherule which often has one or more partial or complete annuli immediately below it. Without basal annulations.

Hydrothecae of variable shape, deeply campanulate, expanding to margin or not, often with an indistinct submarginal ridge or rim; depth variable, usually 1.5–3.5 times marginal diameter. 10–14 marginal cusps; obtusely pointed and variable in height, separated by rounded bays. Annular perisarcal thickening apparently constant in position, distinct and separating off a small, basal chamber, rectangular in side view. Wall

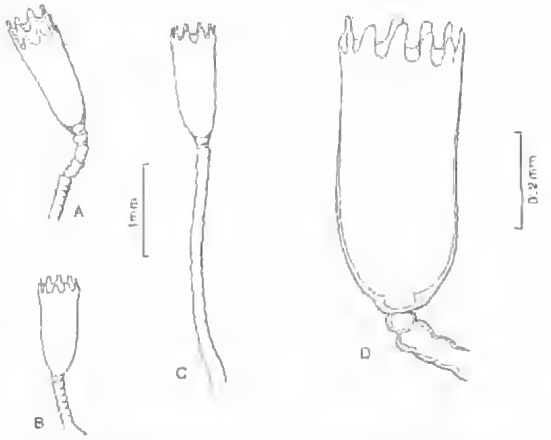


FIG. 24. *Campanularia* sp. (QM GL10207). Portions of hydrothecae showing variations in pedicel length and annulation; renovation of hydrotheca in B. Ndeumba.

thickened to a variable degree, but never so much as in *Orthopyxis integra* (MacGillivray, 1842). Gonothecae not observed.

MEASUREMENTS (μm)

Hydrotheca: depth 200–800; marginal diameter 140–230.

VARIATIONS

Pedicel always with distinct corrugations at the base, but thereafter they may be indistinct, close, or even spiral. Spherule typically depressed, but may be globular. Cusps likewise varying in shape and size: tall, thin and pointed, or short, broad and rounded, with the accompanying intermediates. Margin showing several renovations in some specimens.

REMARKS

This material differs from *Campanularia crenata* Allman, 1876, by the hydrotheca having no basal bulge, not flaring to margin, and lacking longitudinal striations leading from the cusps. It differs from *Orthopyxis crenata* (Hartlaub, 1901b) especially in cusp shape. Both of these species have types which came from the boundary area between the Indian and Pacific Oceans and might, therefore, be expected to occur in Fiji.

There are similarities with *C. africana* Stechow, 1923, but examination of the type in the South African Museum showed it to be distinct. Our material is also close to *C. morgansi* Millard, 1957, but again there are differences. In the absence of gonothecae we cannot identify our specimens with any described species.

Occurrence in Fiji

On red alga (? *Laurencia*), Ndeumba fringing reef, 8 Jul. 79 (QM GL10207).

Family SERTULARIIDAE
Calamphora Allman, 1888
Calamphora campanulata (Warren, 1908)
(Fig. 25)

Sertularella campanulata Warren, 1908: 300
Calamphora campanulata (Warren): Mammen 1965: 35
Calamphora campanulata (Warren, 1908): Millard 1975: 253

Description

Colony stolonial. Hydrotheca solitary, pedicellate; terminal, barrel-shaped, tall, widest in mid-region; with up to 10 transverse annulations or ridges. Margin with four pointed cusps; often showing renovation; four triangular opercular valves. Height of pedicel usually less than depth of hydrotheca, twisted spirally or with corrugations. Gonothecae not observed: similar to hydrothecae but of wider, bulging shape (see Mammen (1965) for further description).

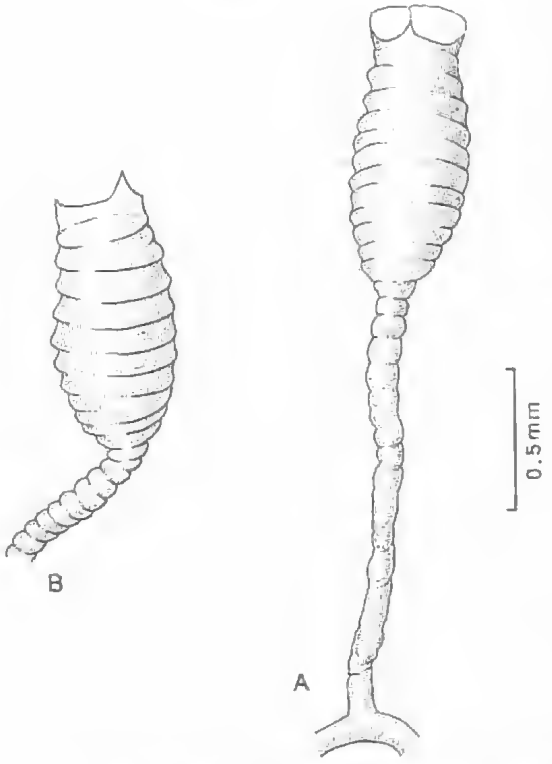


Fig. 25. *Calamphora campanulata*. Hydrothecae. QM GL10208, Joske's reef.

Measurements (μm)

Hydrotheca: length 770–960; marginal diameter 270–330.

Variations and Remarks

Most previous records of this species have been on algae: this was growing over coral rock. Both the hydrothecae and pedicels are longer than described by Mammen (1965) and Millard (1975), though not as long as in *Sertularella solitaria* Nutting, 1904, which we would refer to *Calamphora*. While pedicel length may well be variable, there seem at present no firm grounds for merging *C. campanulata* with *C. solitaria*, especially since Nutting's material was infertile. Otherwise this species is close to *C. parvula* Allman, 1888. Mammen (1965: 35, fig. 67, as *Campanularia*) recorded *C. campanulata* from southern India, and described gonothecae which closely resemble those of *C. parvula* as described by Allman (1888) from Australia. These two nominal species may prove conspecific.

Vervoort (1968, 1972), following Hartlaub (1901a), placed *C. parvula* in the genus *Sertularella*, seeing no reason to retain *Calamphora* for species of *Sertularella* 'that have separate hydrothecae arising from their hydrorhiza, besides normally built colonies'. In fact, *all* the hydrothecae arise from the hydrorhiza in the three species described, and Millard (1975), for example, retained *Calamphora* for such purely stolonial forms. (*Sertularella parvula* Mammen, 1965, is an entirely different, erect species).

Occurrence in Fiji

Joske's reef, 18 Sep. 78 (QM GL10208).

World Distribution

South Africa (Natal), Madagascar, India, Indo-China, Japan and Australia.

Diphasia L. Agassiz, 1862
Diphasia orientalis Billard, 1920
(Fig. 26)

Diphasia orientalis Billard, 1920: 146
D. orientalis: Billard 1925: 212

Description

Colony erect. Stems stiff, monosiphonic and unbranched, reaching 8 mm. Hinge joints, of which there may be more than one, occur only to terminate the basal, athecate part of the stem, which is of variable length and often subdivided proximally by one or more transverse nodes.

Remaining nodes slightly oblique and indistinct. Each internode bearing one pair of lateral hydrothecae, consecutive pairs well separated.

Hydrothecae opposite, most pairs not contiguous; adnate to stem for most of vertical height, pentagonally tubular (the angles ridged), widening gently to margin; free portions diverging from stem at 60–85°; abcauline side the longer; adcauline side slightly thickened. No marginal or internal cusps; one large adcauline opercular valve. Gonotheca not observed, but described by Billard (1925): inserted below hydrotheca, one per internode, to form a single row extending two-thirds up stem length. Male with numerous spines, these often laterally flattened and drawn out to form longitudinal ridges. Distalmost spines surrounding a small, circular aperture and a short collar. Female pyriform, with a broad chamber and three large valves terminating in a point distally; two broad lateral blades.

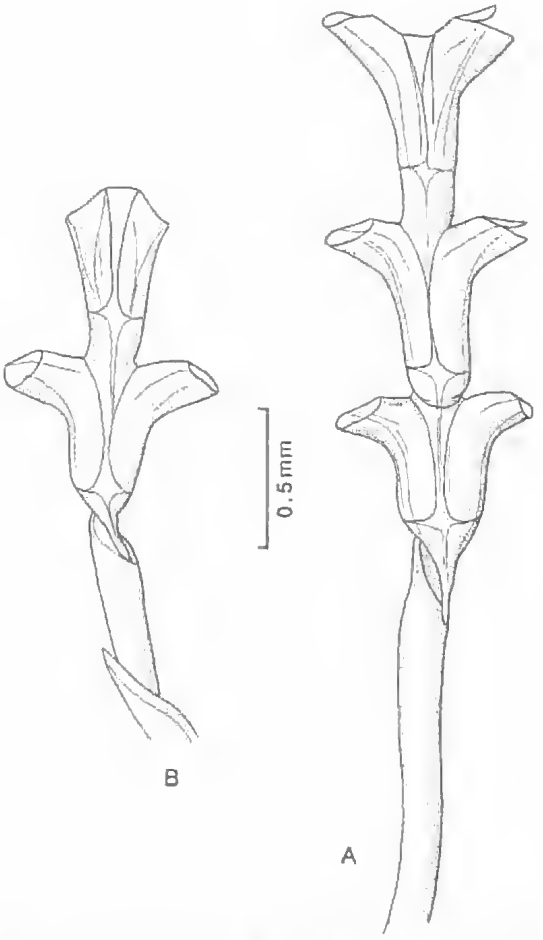


FIG. 26. *Diphasia orientalis*. Parts of stems showing hinge joints near base and hydrothecae. QM GL10209, Suva Barrier reef.

MEASUREMENTS (μm)

Measurements from Billard (1925) in parentheses. Hydrotheca: marginal diameter 160–190 (180–215); free adcauline length 110–200 (310–430); adnate adcauline length: 420–550 (530–760); abcauline length 450–620. Gonotheca (male): length (1000–1070); width (410–460). Gonotheca (female): length (1230–1540); width (575–655).

VARIATIONS

Hydrothecae become closer together distad and may even be contiguous in front (though still separate behind): angle of divergence decreases distad.

REMARKS

The Fijian specimens were smaller than those described by Billard (see 'Measurements').

OCCURRENCE IN FIJI

Forereef, 0–20 m, west of Suva Point, on coral rock, 19 Feb. 80 (QM GL10209).

WORLD DISTRIBUTION

Only previous record: Malay Archipelago, several localities (Billard, 1925).

Dynamena Lamouroux, 1812
Dynamena cornicina McCrady, 1857
(Fig. 27)

Dynamena cornicina McCrady, 1857: 102
D. cornicina McCrady, 1858: Millard, 1975: 261

DESCRIPTION

Colony comprising hydrorhiza bearing erect stems; these thick but not polysiphonic, typically unbranched but pinnate with alternately arranged hydrocladia; reaching 65 mm; divided by slightly oblique nodes into regular thecate internodes, each bearing a hydrocladial apophysis near the base and three cauline hydrothecae; basal internode short and athecate, terminated by a transverse node; hinge joints absent. Apophyses short, terminated by a transverse node. Hydrocladia with a variable number of athecate internodes proximally, with oblique, hinge-type nodes. All distal internodes thecate, with regular, transverse nodes. Each internode with one pair of opposite hydrothecae, these contiguous in front and separate behind.

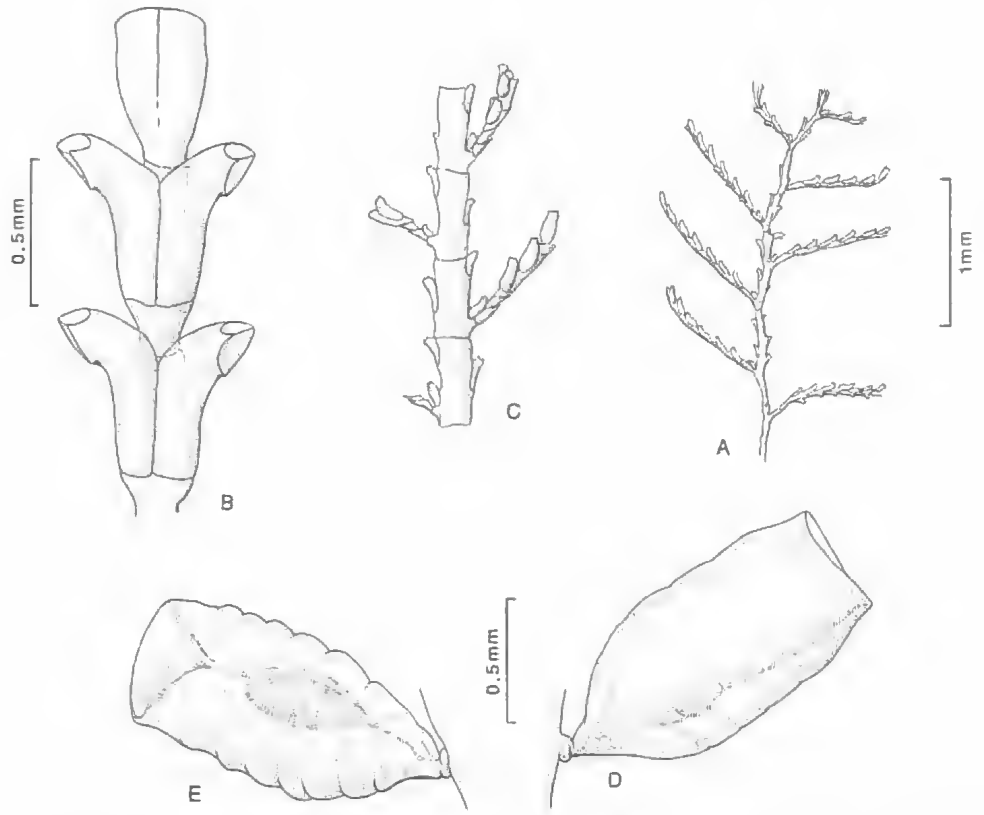


FIG. 27. *Dynamena cornicina*. A, part of colony (QM GL10210); B, part of hydrocladium with hydrothecae; C, stem internodes (B-C, QM GL10212); D, E, gonothecae (QM GL10210/11; Frigate Passage).

Hydrothecae tubular, walls more or less parallel with the stem proximally; then outcurving gradually and evenly to the margin; narrowing little. Adnate for more than three-quarters vertical height, with free adcauline wall at 60–70° to stem. No intrathecal septum. Margin with two, pointed lateral cusps displaced slightly to the adcauline edge; also one large adcauline cusp, extending as far out as the laterals; and one small abcauline internal cusp. Hydrothecal base distinctive, waistcoat-like.

Gonotheca borne on stem, occupying position of apparently damaged cauline hydrotheca (rarely the axial hydrotheca, however); elongate barrel-shaped, distinctly annulated, with broad distal aperture supported by a short collar.

MEASUREMENTS (μm)

Hydrotheca: adnate adcauline length 400–480; free adcauline length 160–240; contiguous adcauline length 340–430; marginal diameter 170–185. Stem (thecate) internode length: 1050–1260. Hydrocladial internode length: 550–650. Gonotheca (Philippines material included): length 1188–540; marginal diameter 468–540.

VARIATIONS

Sporadically along the stem are sometimes found: (a) very short athecate internodes without apophyses; (b) internodes without an apophysis but with up to two pairs of subopposite hydrothecae. Hydrothecae delicate, liable to damage: they become more erect and adnate distad, where the angle of divergence decreases. Unlike most other members of this genus, *D. cornicina* does not have grouped hydrothecae, except on the stem. However, it would not easily be confused with branched *Sertularia* species, for example *S. marginata* (Kirchenpauer, 1864) which, being circumtropical, is quite likely to be found around Fiji, owing to the lack of an abcauline caecum.

OCCURRENCE IN FIJI

Widely distributed on sublittoral coral rock up to about LWST. Ndeumba (with *Hebella scandens*), 18 Mar. 79, with gonothecae (BM

1984.5.17.22; QM GL10210); forereef slope, 14 m, off Suva Point, 3 Apr. 79, with gonothecae; Yanutha reef, 0–20 m, 7 Oct. 79 and Frigate Pass 3–8 m, 2 Nov. 79 (QM GL10212); Mbengga barrier reef, 2 Nov. 79 (BM 1984.5.17.21, 23); below the buttresses at mouth of Makuluva Pass, 15–20 m, 2 May 80. The localities represent a range of conditions from the high energy situation off Suva Point to the shelter of Mbengga leeward reef. Also Verde Rocks, San Agapito Point, Verde I., Philippines, 24 May 81 (QM GL10211).

WORLD DISTRIBUTION

Cosmopolitan in warm waters.

Dynamena crisioides Lamouroux, 1824
(Fig. 28)

Dynamena crisioides Lamouroux, 1824: 613
D. crisioides Lamouroux, 1824: Millard, 1975: 263
D. crisioides var. *gigantea* [in part] Billard 1924: 651

DESCRIPTION

Colony comprising hydrorhiza bearing erect, monosiphonic, straight or slightly geniculate stems, reaching 55 mm; hydrocladia alternate. Stem with short basal part lacking hydrocladia but with one pair of subopposite hydrothecae, terminated by an oblique node; then divided by slightly

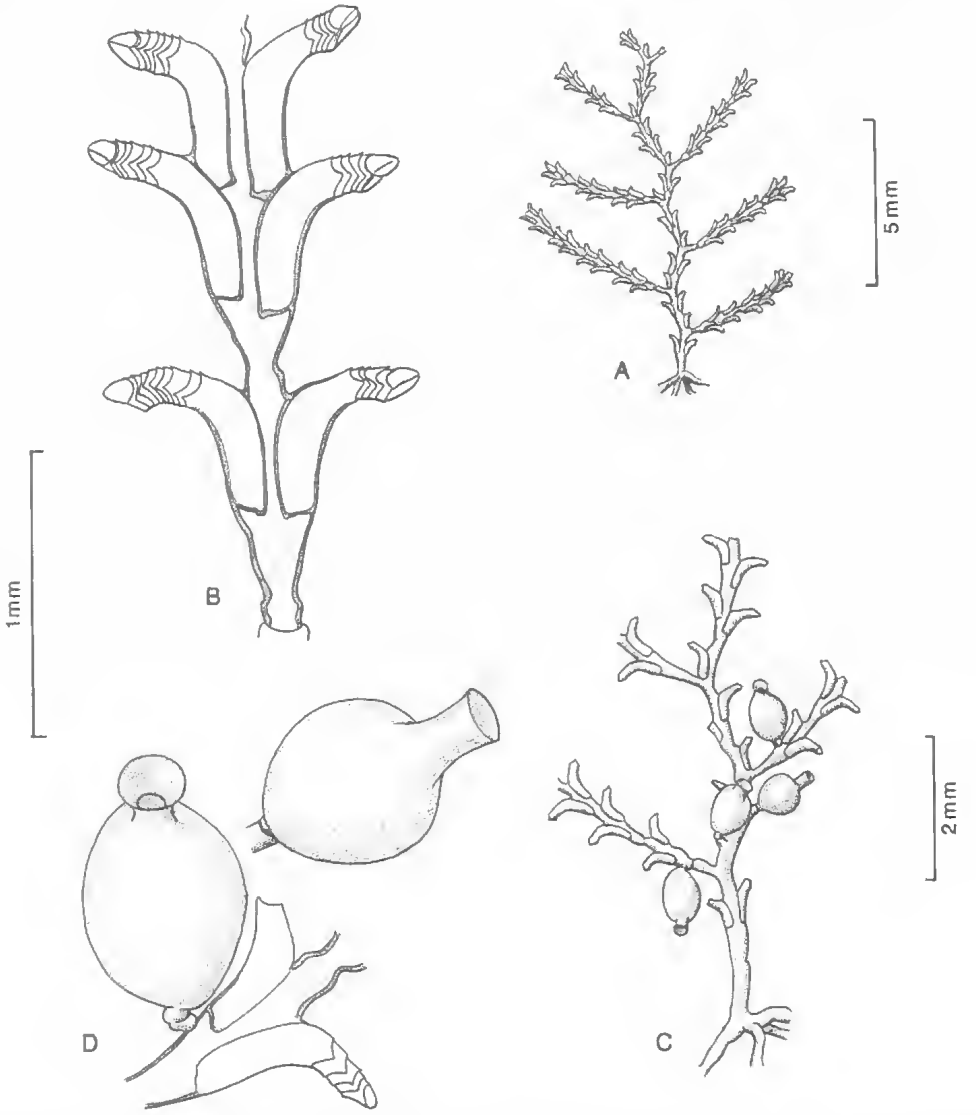


FIG. 28. *Dynamena crisioides*. A, Part of colony (QM GL10213); B, part of hydrocladium with hydrothecae (QM GL 10215, Mba); C, part of colony with gonothecae; D, gonothecae (QM GL 10214, Suva Barrier Reef).

oblique nodes into regular internodes, each with a long hydrocladial apophysis near base and subsequently one axillary and two subopposite hydrothecae. The apophysis may be divided by a transverse node. Hydrocladia divided by slightly oblique nodes into irregularly-spaced internodes bearing a variable number of subopposite hydrothecae; consecutive pairs may overlap. Members of a pair never contiguous in front.

Hydrothecae on sides of stem and hydrocladia, tubular, adnate for more than half vertical height, then outcurved. Angle of adcauline wall with the stem axis variable, 65–80°, with an angular shoulder at the point of adnate divergence, sometimes concealed by the overlap from the next hydrotheca. Intrathecal septum absent. Margin with two pointed lateral cusps, displaced slightly to the abcauline edge, and one smaller adcauline cusp. Abcauline thecal wall thickened; internal cusp absent.

Gonothecae arising from stem or hydrocladia; on former from within hydrothecae and on the latter from below the first pair of hydrothecae. Smooth, ovoid and with an operculate aperture on a long forward-curled neck.

MEASUREMENTS (μm)

Measurements for normal form and var. *gigantea* respectively. Hydrotheca: adnate length 380–540, 522–666; free adcauline length 120–500, 72–360; marginal diameter 130–220, 144–180. Stem internode length: 700–1500, 2100–2700. Hydrocladial internode length: 1080–1350, 2100–3400. Gonotheca: length 900–1800, —; maximum diameter 540–720, —; marginal diameter 198–252, —.

VARIATIONS

This has long been recognized as a very variable species, and two forms have been found in Fiji; the normal, <20 mm high, with the stem distinctly geniculate and having up to three pairs of hydrothecae per hydrocladial internode; and var. *gigantea* Billard (1924), taller, with a straight stem and up to six pairs of hydrothecae per hydrocladial internode. Number of apophyses and hydrothecae per cauline internode variable, even zero. Renovation of hydrothecal margin common, often leading to considerable extension. Hydrocladial branching rare. Tendrils resembling hydrorhizae often arise from the ends of hydrocladis or stem and may then insert elsewhere in the colony.

OCCURRENCE IN FIJI

Common and widely distributed; the only hydroid to occur on coral boulders that endure long emersion. Many records from Suva barrier reef (BM 1984.5.17.16; QM GL10214); also on *Sargassum* in the backreef lagoon (Nasese, Suva), Ndeumba (QM GL10213) and on the flats of Yarawa (BM 1984.5.17.17; QM GL10215), Tailevu Point (BM 1984.5.17.18) and Vunda. *Hebella scandens* (frequently) and *Clytia hemisphaerica* occur on it. *D. crisioides* was also collected on the windward reef at Tanaea, Tarawa atoll, Kiribati, 11 Feb. 79 (BM 1984.5.17.19), and from London pier, Christmas I. (Line group), bearing both *H. scandens* and *C. hemisphaerica*, 16 Feb. 79. The var. *gigantea* was from Yarawa reef (BM 1984.5.17.20; QM GL10216).

WORLD DISTRIBUTION

Warm water cosmopolitan.

Dynamena quadridentata (Ellis and Solander, 1786) (Figs. 29, 30)

Sertularia quadridentata Ellis and Solander, 1786: 57
Dynamena quadridentata (Ellis and Solander, 1786): Millard 1975: 266 (cum syn.).

Two forms of this species were found in Fiji: we refer to them as 'A' and 'B'.

DESCRIPTION OF FORM 'A' (Fig. 29)

Colony comprising erect, unbranched stems arising from the hydrorhiza. Hydrorhiza broad, with regular internal perisarcal pegs. Stems monosiphonic, unbranched, reaching 2 mm. Basal athecate portion short, terminated by a hinge joint; subsequent internodes thecate with very oblique, hinge-like nodes. Hydrothecae in groups or in separated pairs, members of any pair contiguous in front, separate behind. Stems with never more than three internodes, basal one(s) with a pair of hydrothecae, distal one with groups.

Structure of hydrothecae varying according to whether they comprise single pairs or groups, and further influenced by position within the group. For *hydrothecae in single pairs*: abcauline wall more or less parallel with stem axis before turning gradually up and out, but slightly swollen at the base and again just above; adnate for more than three-quarters vertical height, and members of a pair contiguous for most of that; free adcauline wall at 60–75° to stem. For *grouped hydrothecae*: adnate for nearly entire vertical height, considerable overlap between consecutive pairs of hydrothecae; contiguity between members of pair

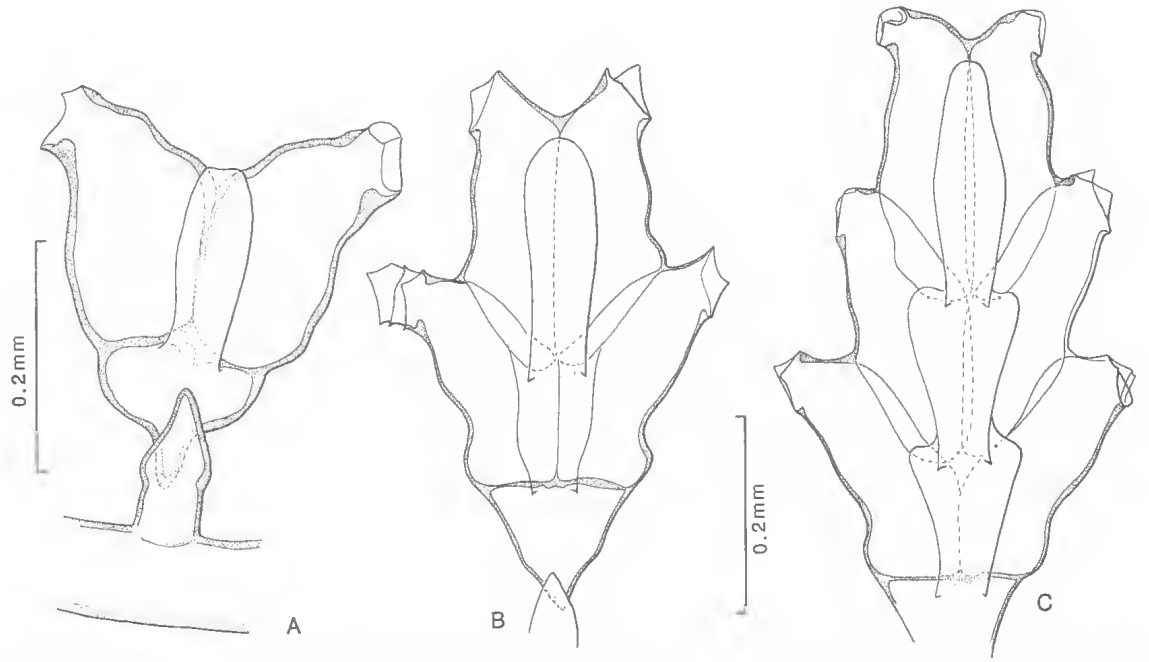


FIG. 29. *Dynamena quadridentata* (Type A). A, basal internode with pair of hydrothecae; B, distal internode with two pairs of hydrothecae; C, distal internode with three pairs of hydrothecae. (QM GL 10217). Ndeumba.

increasing distad, non-contiguous part of adnate adcauline wall sigmoidal, free part short, angle of free adcauline wall to stem axis approximately 90°, but decreasing distad; proximal pair with basal and mid-region swellings on abcauline wall.

All hydrothecae with thickened ad- and abcauline walls, without intra-thecal septa. Margin narrow, with three cusps: one adcauline, small, and two midlateral, triangular; also two relatively large internal cusps, ad- and abcauline.

Gonotheca not observed; see Millard (1975) for description.

VARIATIONS

The basal thecate internode may frequently have grouped hydrothecae, but the number per group increases distad. Margin renovation is common. Lateral cusps may show asymmetry. A small abcauline marginal cusp sometimes apparent but actually an extension of abcauline internal cusp.

DESCRIPTION OF FORM 'B' (Fig. 30)

More or less as 'A' but reaching 5 mm. Hydrorhiza lacking internal perisarcal pegs. Stem nodes much more indistinct, with hinge joints occurring sporadically. All stems with several single hydrothecal pairs basally and one or two groups distally. Hydrothecae in single pairs, lacking the two abcauline swellings of 'A', smooth and evenly concave; adnate for nearly entire vertical height, then bent out at approximately 90°; sometimes grossly enlarged, up to 2.5 times normal. Grouped hydrothecae not overlapping to the same degree as in 'A'; the adnate, non-contiguous part of adcauline wall not sigmoidal. Free portion of adcauline wall much longer than in 'A'. Margin with three cusps, one adcauline, small, and two lateral, well developed; laterals may again be asymmetrical and a fourth, abcauline cusp illusory; internal cusps prominent and large; margin renovation common. Gonotheca borne on the stem below the first pair of hydrothecae: barrel-shaped with five shallow annulations; distal aperture broad and raised.

MEASUREMENTS

See Table 1.

REMARKS

The two forms of *D. quadridentata* from around Fiji are very different in appearance. However, such variation is well documented, as evidenced by the number of described varieties (see Billard, 1925; Millard, 1975). Form 'A' resembles the 'classical' *D. quadridentata* (see Billard, 1925) while form 'B' agrees with Millard's (1958) material and account of *D. quadridentata* var. *nodosa* Hargitt, 1908. It also resembles *D. heter-*

TABLE 1. Measurements of *Dynamena quadridentata* and *D. heterodonta* from various sources: *D. quadridentata*, Fiji, forms 'A' and 'B'; 1, *D. quadridentata* var. *nodosa*, Caribbean (van Gemerden-Hoogaveen, 1965); 2–4, *D. heterodonta*; 2, French Polynesia (Vervoort and Vasseur, 1977); 3, Indian Ocean (Cargados Garajos), BM 1923.2.15.146; 4, as 3, BM 1923.2.15.152.

MEASUREMENTS (μm)	FORM A	FORM B	1	2	3	4
Hydrothecae: vertical height	215–315	200–290	200–320	230–265		
marginal diameter	60–75	75–85	60–110	80–95	65–75	65–80
adnate adcauline length	200–270	200–305	200–300	135–190	200–265	215–225
free adcauline length	50–110	75–170	140–235	200–270	60–90	120–150
contiguous adcauline length	105–230	90–180	75–175		100–240	100–160
Internode length		325–900	440–1250			475–720
Gonothecae: height		936–1044				
marginal diameter		306–450				

odonta (Jarvis, 1922). Despite the acknowledged similarity of *D. heterodonta* with *D. quadridentata*, and Vannucci's (1951) placement of the former as a variety of the latter, the species *heterodonta* persists in the literature. While we cannot here resolve the issue, we question the independent validity of *heterodonta*.

D. quadridentata and *D. heterodonta* have been separated by:

(1) The presence of internal perisarcal pegs in the hydrorhiza of *D. quadridentata* (Billard, 1925; present observations) absent from *D. heterodonta* (Jarvis 1922, Type BM 1923.2.15.146).

(2) The free portion of the hydrotheca is relatively longer in *D. heterodonta* (Billard, 1925; Vervoort and Vasseur, 1977).

(3) A fourth, abcauline marginal cusp has been reported in *D. heterodonta* (Vervoort and Vasseur, 1977).

(4) The lateral cusps of *D. heterodonta* are

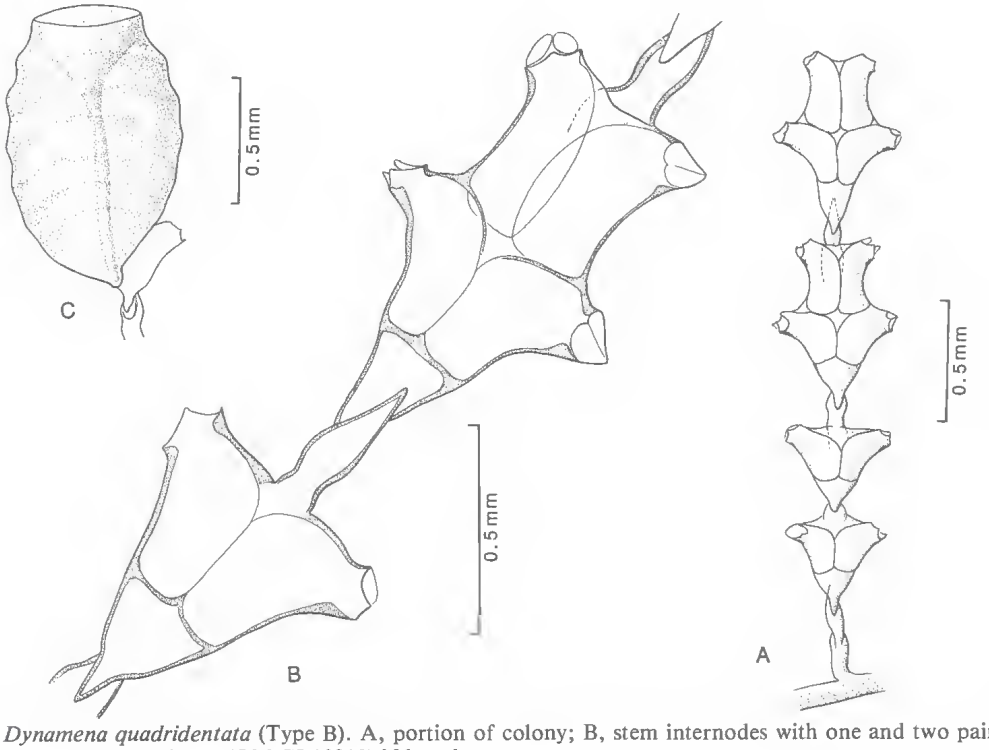


FIG. 30. *Dynamena quadridentata* (Type B). A, portion of colony; B, stem internodes with one and two pairs of hydrothecae; C, gonotheca. (QM GL10218) Ndeumba.

unequally developed, leading to the formation of an opercular-cone (Vervoort and Vasseur, 1977) which is absent in *quadridentata*.

There is evidence suggesting that the supposed differences between the two nominal species do not exceed the range of variation of *D. quadridentata*. Thus:
(1) *D. quadridentata* has been recorded both with and without perisarcal pegs in the hydrorhiza (*cf.* Billard, 1925 and Vervoort, 1968).
(2) 'Long' free portions of the hydrotheca have been noted by Millard (1958) in *D. quadridentata* var. *nodosa*, while 'short' free portions are evident in some hydrothecae on the type specimen of *D. heterodonta*. The latter species displays a tendency to margin renovation and, hence, to lengthening of the free portion. If the renovations are ignored, much of the length difference disappears. Margin renovation, moreover, does occur in *D. quadridentata s. str.* (present observations).
(3) The abcauline marginal tooth in Vervoort and Vasseur's description of *D. heterodonta* is not a feature of the type. What appears to be a cusp is actually an extension or renovation of the abcauline internal cusp. Internal cusps are known to be variably developed in *D. quadridentata* (Millard, 1975).
(4) Examination of material referred to *D. quadridentata* in the South African Museum reveals rare instances of unequally developed marginal cusps, such that small opercular cones appear. Contrariwise, not all hydrothecae of the type specimen of *D. heterodonta* display this cone.

The gonothecae of both nominal species are barrel-shaped and annulated, with 4–8 annulations in *D. quadridentata* (Billard, 1925; Millard, 1958; Vervoort, 1968) and 5–6 in *D. heterodonta* (Jarvis, 1922; Vannucci, 1951; Vervoort and Vasseur, 1977).

While the arguments for not merging *D. heterodonta* with *quadridentata* are perhaps subjective, we are reluctant to do so for the following reasons:
(1) Ellis and Solander's type material has almost certainly been lost, and we can find no evidence of any subsequent author having made direct observations on the type.
(2) The obvious opercular cone of *D. heterodonta* is at most weakly produced in *D. quadridentata*. This may, of course, be environmentally induced, but until stronger evidence can be provided, we feel that it is a character which should not be ignored.

The absence of such a cone in the Fijian material causes us to treat it as *D. quadridentata*.

Occurrence in Fiji

Form A: Usually on algae, often associated with encrusting sponges. Among *D. crisioides* and sponge on coral rubble, Suva barrier reef flat, 25 Jul. 78 and in sponge, Ndeumba fringing reef, 20 Aug. 78 (QM GL10217). Form B: On red algae, with small form of *Hebella scandens*, Ndeumba, 8 Jul. 79 (QM GL10218); on coral rock, Great Astrolabe reef, 12 Jul. 80.

World Distribution

Circumglobal in warm temperate and tropical waters.

Salacia Lamouroux, 1816
Salacia tetracythara Lamouroux, 1816
(Fig. 31)

Salacia tetracythara Lamouroux, 1816: 212
S. tetracythara Lamouroux: Billard 1925: 202

Description

Colony erect; stems moderately stiff, reaching 30 mm; polysiphonic in lower parts and usually unbranched; bearing alternate hydrocladia; divided by regular oblique nodes into thecate internodes each bearing a hydrocladial apophysis and three cauline hydrothecae, inferior, axillary, and opposite; apophysis short, with an oblique node.

Hydrocladia branching at a wide angle to the stem, usually 75–90°, and in the same plane; slightly narrower than the stem; nodes distinct and slightly oblique; internodes of variable length, with an inconstant number of subopposite hydrothecae. Hydrothecae on the sides of the hydrocladia, in overlapping pairs, not contiguous; tubular, adnate for almost entire length, outcurved distally and narrowing a little to margin; abcauline wall thickened and more or less parallel with hydrocladial axis throughout. Intrathecal septum absent. Margin delicate, often showing signs of renovation; with three marginal cusps, two obscure laterals and one large pointed adcauline; also a single abcauline internal cusp.

An inconstant number of gonothecae borne proximally on hydrocladia, below hydrothecae; barrel-shaped, smooth; aperture distal, broad, on a short collar, surrounded by a thin ridge.

Measurements (μm)

Hydrotheca: marginal diameter 130–140; adnate adcauline length 400–550; free adcauline length 310–350; abcauline length 65–105. Gonotheca: length 882–1134; marginal diameter 396–558.

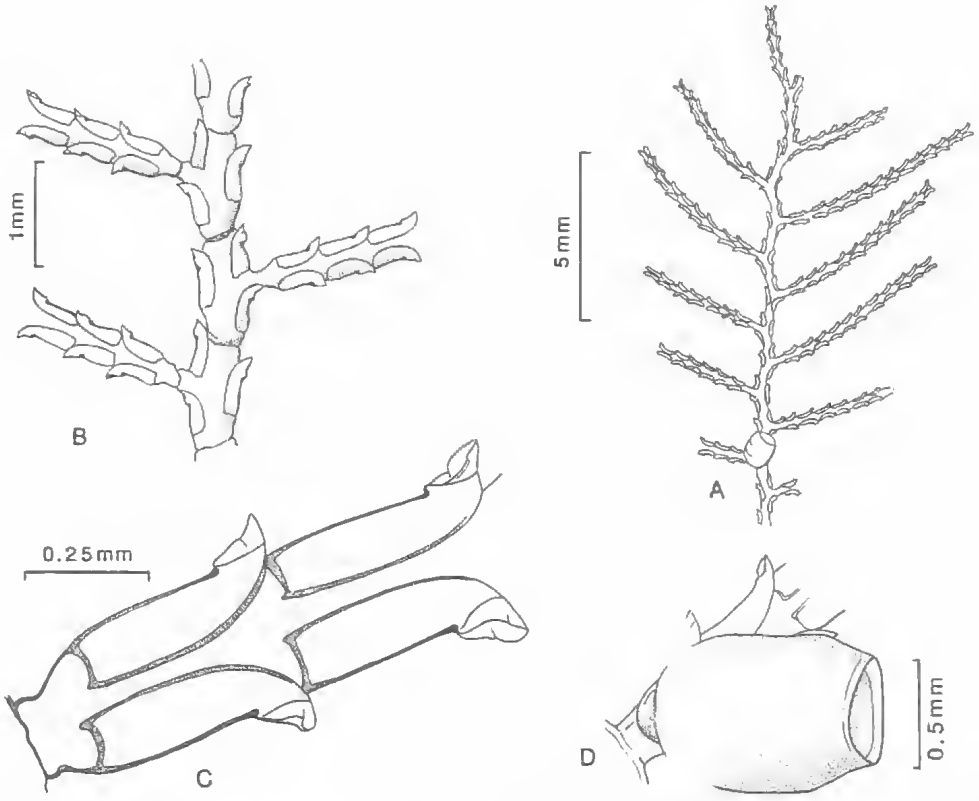


FIG. 31. *Salacia tetracythara*. A, part of colony; B, part of stem; C, hydrothecae (QM GL10220, Suva barrier reef); D, gonotheca (QM GL10219, Ndeumba).

VARIATIONS

Stem polysiphonic only near the base, with hydrocladia arising from both axial and peripheral tubes. Hydrocladial branching rare, and only if the hydrocladium itself is polysiphonic: the two resultant hydrocladia in different planes. Apical tendrils common. Typically three cauline hydrothecae per stem internode, occasionally one subopposite pair and no hydrocladial apophysis. More than one gonotheca may arise from the same place.

OCCURRENCE IN FIJI

At LWST on coral rock, Suva barrier reef, 29 Mar. 79 (QM GL10220), Ndeumba fringing reef, 20 Aug. 78 (QM GL10219), 18 Mar. 79, 8 Jul. 79, and windward Great Astrolabe reef, 12 Jul. 80; 3–8 m in Frigate Pass, Mbengga leeward barrier reef, 2 Nov. 79. Reproductive in July, August and November.

WORLD DISTRIBUTION

India, Malay Archipelago, Queensland.

Sertularella Gray, 1848

Sertularella diaphana (Allman, 1886)
(Fig. 32)

Thuiaria diaphana Allman, 1886: 145
Sertularella diaphana (Allman): Billard 1925: 157
Sertularella diaphana (Allman, 1886): Millard 1975: 285

This species occurs in Fijian waters in two varieties, the typical form and var. *delicata* Billard (1925), which display same general colony structure but differ in size and points of microstructure.

DESCRIPTION

Colonies variable; stems generally unbranched, pinnate, with alternate hydrocladia in one plane; divided into regular internodes by nodes which slope alternately right and left. Stem internodes with a short hydrocladial apophysis in the upper half and three hydrothecae: inferior, subopposite,

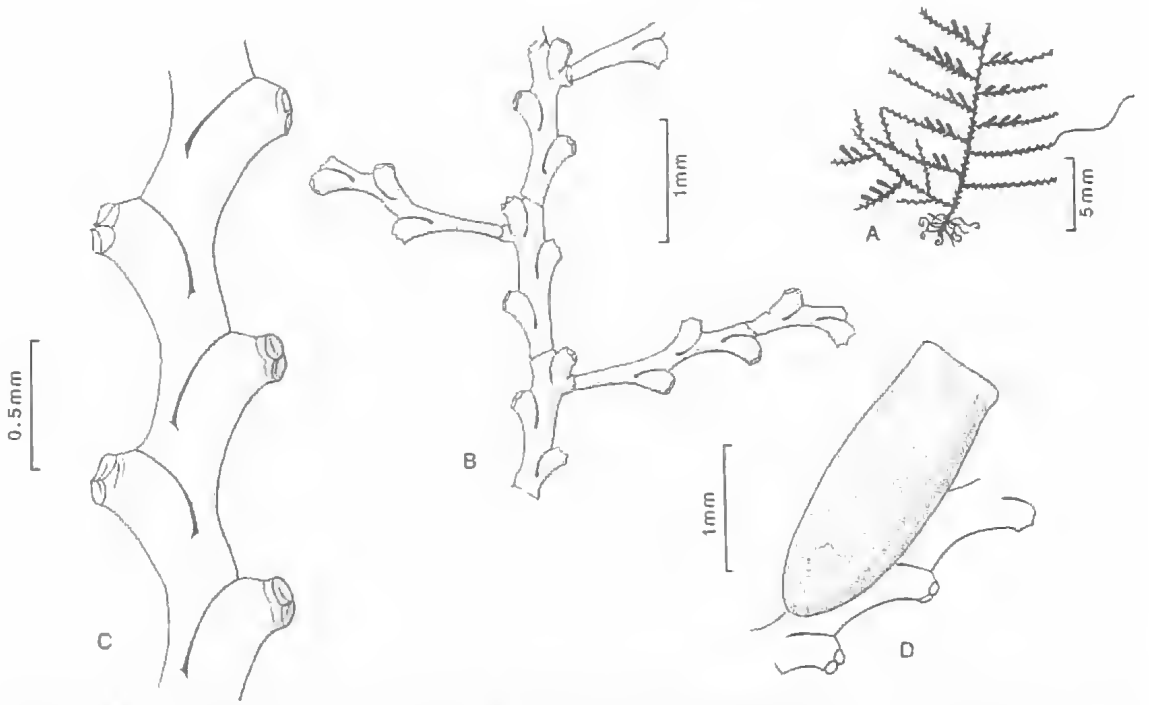


FIG. 32. *Sertularella diaphana*. A, habit; B, part of stem and hydrocladia (var. *delicata*, QM GL10222, Great Astrolabe Reef); C, hydrothecae; D, gonotheca (QM GL10221, Makuluva Pass).

and axillary. Hydrocladia divided into internodes by sloping nodes as in the stem.

Hydrothecae on the lateral surfaces of stem and hydrocladia, nearly completely adnate, smooth and outcurved: abcauline wall variably concave; free portion of adcauline wall straight, short, and at 90–100° to the stem. Margin with four low cusps, thickened. In var. *delicata* hydrothecae also arising direct from the hydrorhiza.

Gonothecae observed in the typical form only: borne below the hydrothecae on the anterior surface of the hydrocladium; elongated, tapering proximad and truncated distally; with a variable number of distinct longitudinal ridges.

MEASUREMENTS (μm)

Measurements for typical form and var. *delicata* respectively. Stem: internode length 1250–1500, 1000–1350; width 510–690, 170–260. Hydrocladia: internode length 3000–4700, 1000–1450; width 230–340, 140–180. Hydrotheca: adcauline adnate length 425–500, 215–290; adcauline length 75–125, 40–110; marginal diameter 150–180, 150–175. Gonotheca: length 2142–2474, —; marginal diameter 657–756, —.

VARIATIONS AND REMARKS

The stem in the typical form tends to be stiff, thick, and polysiphonic, especially basally, reaching a height of 80 mm. The hydrocladial (as opposed to stem) internodes are of variable length, with the number of hydrothecae correspondingly inconstant. In var. *delicata*, in contrast, the stem is flexible, thin, monosiphonic, slightly geniculate and attains a height of only 15 mm. It is also sometimes epizoic. Such differences could not be the result of age, even though short colonies of the typical form are known to be epizoic, since these are usually polysiphonic basally. We agree with Billard that the two can be separated by size (see 'Measurements'), stem structure, and degree of curvature of the adcauline hydrothecal wall (that of var. *delicata* being the more recurved at the base, thereby restricting communication with the stem or hydrocladium). However, our material does not conform with his statement that the free part of the adcauline thecal wall is longer in *delicata* than in the typical form (indeed, if one examines Billard's (1925) figures of the two varieties, the difference appears almost non-existent for the latter). The two varieties from Fiji are similar in this respect. This character is obviously inconsistent. Another feature by which our specimens in the two forms differ is the degree of concavity of the abcauline hydrothecal wall, which is more even, smooth and predictable in var.

delicata, though the typical form shows a greater tendency to thicken the adcauline wall unevenly at the base. We have not recorded var. *gigantea* Billard (1925).

S. diaphana might also be confused with *S. decipiens* Billard, 1919, which has the same hydrothecal shape with a short but distinct free adcauline wall, but also has a pronounced abcauline internal cusp and a complete hydrothecal base.

Occurrence in Fiji

The typical form found below the buttresses, Makuluva reef (seaward end of the Pass), 15–20 m, reproductive, 2 May 80 (BM 1984.5.17.34; QM GL10221). Var. *delicata* was on *Gymnangium hians* and on coral rock, windward Great Astrolabe reef, 24 Jun. 78 (QM GL10222).

World Distribution

Warm water cosmopolitan.

Sertularella minuscula Billard, 1924
(Fig. 33)

Sertularella minuscula Billard, 1924: 648
Sertularella minuscula: Billard 1925: 139
Sertularella minuscula Billard, 1924: Pennycuik 1959: 195; van Gemerden-Hoogeveen 1965: 34

Description

Colony comprising a hydrorhiza bearing erect, monosiphonic, unbranched stems reaching 7 mm. Proximally a short, athecate internode of variable length; then regular thecate internodes with oblique but indistinct nodes. Internodes long and slender, often annulated at base. Hydrothecae alternate, one per internode, lateral, in one plane; long, tubular, adnate for one-third to one-half of vertical height, but for less than one-quarter of the adcauline length. Curving gently outward; abcauline wall straight or slightly concave, adcauline convex; angle of adcauline wall with

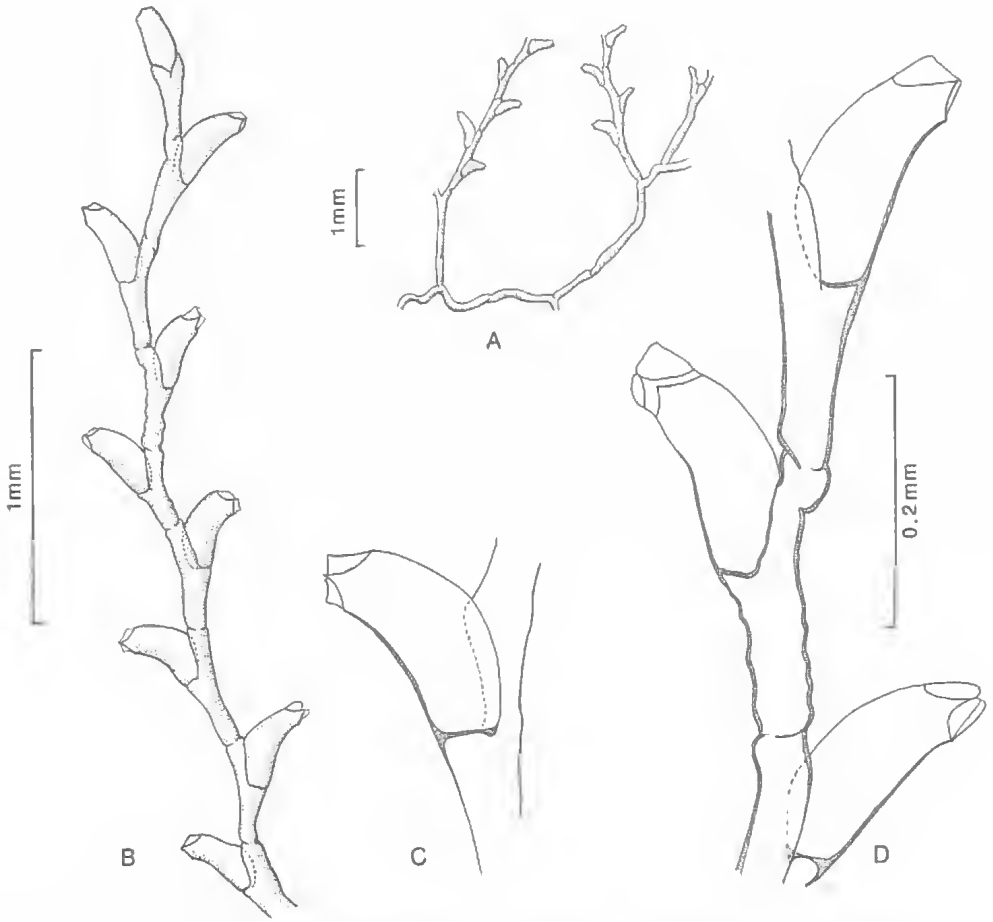


Fig. 33. *Sertularella minuscula*. A, habit; B, stem; C, D, hydrothecae. Thangilai (QM GL10223).

stem axis 30–60°; smooth; margin narrow, facing out and up, with four distinct cusps, not thickened and without internal cusps; renovation common. Gonothecae not observed; see van Gemerden-Hoogeveen (1965) for description.

MEASUREMENTS (μm)

Internode length: 330–480. Hydrotheca: adcauline free length 140–240; adcauline adnate length 110–165; abcauline length 200–325; marginal diameter 80–105; vertical height 200–290.

VARIATIONS

Branches, originating from within damaged hydrothecae, occur rarely and have the same structure as the stem. Solitary hydrothecae arise at irregular intervals from the hydrorhiza.

OCCURRENCE IN FIJI

On coral rock, edge of Thangilai reef, 28 Apr. 79 (QM GL10223); Suva barrier reef, 19 Feb. 80; Great Astrolabe Reef, 12 Jul. 80; on coral rock and algae, Ndeumba, 18 Mar. 79 (QM GL10224).

WORLD DISTRIBUTION

Tropical and sub-tropical waters: Indian Ocean (Gulf of Manaar), Indonesia (Timor), Great Barrier Reef (Heron and Low Is.), Caribbean (Bonaire).

Sertularia Linnaeus, 1758
Sertularia borneensis Billard, 1924
(Fig. 34)

Sertularia borneensis Billard, 1924: 649
Sertularia borneensis: Billard 1925: 171
Sertularia borneensis Billard, 1924: Pennycuik 1959: 197
Sertularia westindica Stechow: Cooke 1975: 100
Sertularia turbinata: Vervoort and Vasseur 1977: 60

DESCRIPTION

Colony comprising a hydrorhiza bearing erect, monosiphonic, unbranched stems reaching 13 mm; nodes oblique, with a hinge joint terminating the short basal athecate part of the stem; each internode bearing a pair of opposite hydrothecae; members of pair may be contiguous in front but most are separate both in front and behind.

Hydrothecae without abcauline intrathecal septum; swollen basally, narrowed above; outcurved. Angle of adcauline wall with stem axis variable, 70–90°; contiguous for more than one-half vertical height. Shoulder variably prominent, related to degree of hydrothecal contiguity; more or less at point of hydrothecal separation. Margin

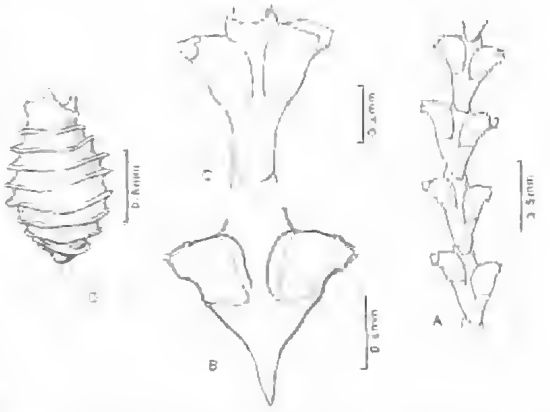


FIG. 34. *Sertularia borneensis*. A, Part of stem; B, basal pair of hydrothecae; C, more distal pair of hydrothecae; D, gonotheca. QM GL10225, Philippines.

thickened, with three cusps: two well-developed triangular midlaterals and one small adcauline cusp. Ab- and adcauline walls thickened, with one small, abcauline internal cusp.

Gonothecae (based on specimen collected by JSR from Verde I. Passage, Philippines, 24 May 81) on stem at colony base below the first pair of hydrothecae. Elongate, barrel-shaped, narrowing distally. Aperture on short but distinct collar with two lateral 'horns'; distinctly ridged and pagoda-like.

MEASUREMENTS (μm)

Measurements for Fiji; Vervoort and Vasseur (1977), Siboga Stn. 80 material (*cf.* Billard, 1925); and Vervoort and Vasseur (1977), Moorea respectively. Hydrotheca: vertical height 190–285, 295–325, 255–260; adnate adcauline length: 200–230, 160–175, 120–135; free adcauline length 95–135, 245–260, 200–215; marginal diameter 95–120, 95–110, 70–80. Internode length: 490–1025, 525–555, 365–405. Gonothecae (two only, Philippines): length 1170, marginal diameter 378–432.

VARIATIONS

As in *S. turbinata*, proximal hydrothecae are short and squat, and rarely contiguous in front; each makes an angle of divergence of approximately 90°, and has a distinct basal swelling. Distal hydrothecae may become contiguous; each has a reduced angle of divergence, an indistinct basal swelling, and is more upright. Hydrothecae may occur in sub-opposite pairs. Some internodes may have more than one pair of hydrothecae, in which case the internode is long and bears proximal and distal pairs. Hydrothecae may be grossly enlarged,

up to 2.5 times normal volume. Margin renovation is common. Tendrils commonly arise at stem apices, insert on the substratum and ramify, throwing up new colonies. Branching rare: basal athecate internode may branch dichotomously and bear a transverse node terminally; then typically a second athecate but short internode (with terminal hinge joint) follows before the normal pattern is resumed.

REMARKS

Sertularia borneensis, first described by Billard (1924) and subsequently identified from Queensland by Pennycuik (1959), has had a chequered taxonomic history. Mammen (1965) and Cooke (1975) referred it to *S. westindica* Stechow, 1919b, and Vervoort and Vasseur (1977) to *S. turbinata* (Lamouroux, 1816). The type material of *S. westindica* unfortunately lacked gonothecae. Billard (1925) himself recognized the similarity between *S. borneensis* and *S. westindica*, but Mammen's arguments for merging the two are far from convincing, being based on characters of acknowledged variability. He noted a general resemblance between them which we find unsupported by the relevant illustrations (Stechow, 1919b, fig. 6; Mammen, 1965, fig. 71). While the two nominal taxa may yet prove to be the same species, merging seems premature so long as the reproductive structures in *S. westindica s. str.* remain undescribed.

S. turbinata is characterized by its abcauline intrathecal septum, a feature noted to some extent in all the descriptions prior to Vervoort and Vasseur (1977). Their merging of the two species was based on an observation that young and developing colonies from Moorea, lacking abcauline intrathecal septa, were identical with those described and illustrated by Billard (1925) as *S. borneensis*: an observation that was supported by an examination of the holotype. However, in our opinion, their material should have been referred to *S. borneensis*. On the evidence of material from Fiji, we disagree with Vervoort and Vasseur that the absence of the septum in *S. turbinata* is a juvenile character. Our material of *S. borneensis* was of good height and in reproductive condition, but otherwise identical with Vervoort and Vasseur's (1977) description. Moreover, the gonothecae are different from those described in published accounts of *S. turbinata*.

No gonosomal material of *S. borneensis* was reported by either Billard or Pennycuik (1959), and the gonothecae in our material are different from those described by Mammen for *S. westindica*. We feel justified in referring our specimens to *S. borneensis* since they are from the Philippines, much closer to the type locality than Mammen's collection.

It appears that many species of *Sertularia* have hydrothecae that are similar but differ in their gonothecae. We provisionally refer both the infertile colonies from Fiji and *S. westindica sensu* Cooke (1975) to the present species.

OCCURRENCE IN FIJI

Thangilai reef, 28 Apr. 78; on red algae, Ndeumba fringing reef, 13 Dec. 78 (QM GL 10226); on coral rock, windward Great Astrolabe reef, 12 Jul. 80. Also from Verde Island, Philippines, 24 May 81 (QM GL10225).

WORLD DISTRIBUTION

Indonesia (Makassar Strait), Philippines, Great Barrier Reef, Marshall Islands, French Polynesia.

Sertularia hupferi Broch, 1914
(Fig. 35)

[?] *Sertularia rugosissima* Thornely, 1904: 118
Sertularia hupferi Broch, 1914: 34
Sertularia hupferi Broch, 1914: Millard and Bouillon 1973: 72

DESCRIPTION

Colony comprising a hydrorhiza bearing erect, monosiphonic, unbranched stems reaching 3.5 mm; nodes acutely oblique, resembling hinge joints. Basal athecate part of colony always short and sometimes with a proximal transverse node. True hinge joints terminate the basal part of the stem and may occur sporadically in the distal region. Each internode bearing a pair of opposite hydrothecae, contiguous in front (except often at colony base), separate behind.

Hydrotheca without intrathecal septum, basal swelling slight; narrowing above; outcurved; angle of adcauline wall with stem axis 60–80°; shoulder discernible but not prominent, more or less at point of hydrothecal separation; with about 20 transverse ridges, these rarely complete, but approaching the contiguous wall distally; incomplete ridge ends united by a longitudinal ridge. Margin delicate, with three marginal cusps: two unridged, pointed laterals displaced slightly to the adcauline edge, one small adcauline cusp. Hydrothecae thickened on abcauline wall and with a distinct abcauline internal cusp.

Gonothecae not observed.

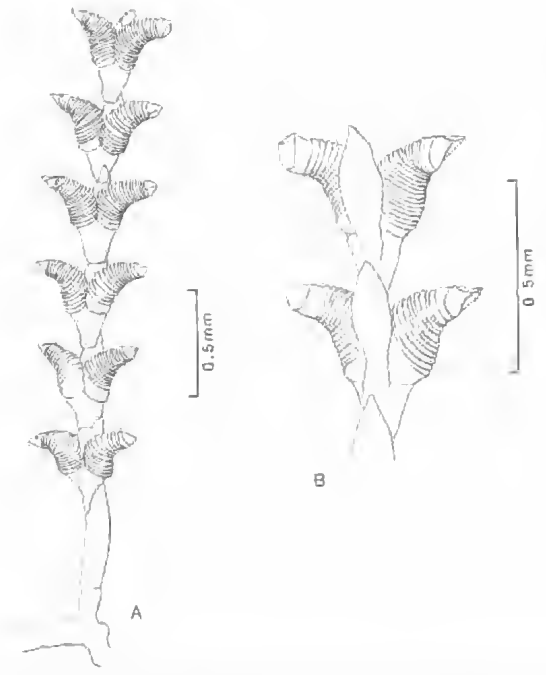


FIG. 35. *Sertularia hupferi*. A, stem, from anterior; B, two pairs of hydrothecae, from posterior. QM GL10227, Suva Barrier Reef.

MEASUREMENTS (μm)

Measurements for *S. rugosissima* (BM 1907.8.27.6); Millard and Bouillon (1973); and Fiji respectively. Hydrotheca: vertical height 275–360, 140–290, 150–170; adnate adcauline length 225–255, 150–270, 175–225; free adcauline length 200–275, 110–120, 125–200; marginal diameter 100–130, —, 40–70; contiguous length 75–130, —, 75–145. Internode length: 500–600, —, 325–380.

VARIATIONS

Adnate hydrothecal length increases and the angle of divergence decreases distad. In some specimens a faint, second, internal adcauline cusp was observed.

REMARKS

This material agrees very well with that from the Seychelles (Millard and Bouillon, 1973): but there is also a resemblance to *S. rugosissima* Thornely (1904), from Ceylon. The type slide (BM 1907.8.27.6) reveals that Thornely's illustration is inaccurate and that *S. rugosissima* possesses one, very prominent, abcauline internal cusp and possibly also a second fainter, adcauline one; the hydrothecae are also more extensively adnate than shown. The hydrothecae are much larger than in our material (though the specimen is very squashed). In the absence of a sufficient range of material, however, we feel it best to refer our material to *S. hupferi*. Thornely (1916) herself later referred *S. rugosissima* to *S. hupferi* (see Cornelius, 1979, p.308, note 5). Although this material may superficially resemble *Diphasia tropica* Nutting, 1904, and *D. delagei* Billard, 1912 (see Cornelius, 1979), it differs from them in two fundamental ways: the presence of an abcauline caecum, and the narrowing, not flaring, of the hydrotheca towards the margin.

OCCURRENCE IN FIJI

On red algae, Ndeumba fringing reef, 13 Dec. 78, 9 Sep. 79; on coral rock at reef crest, Suva barrier reef, 27 Apr. 79 (QM GL10227).

WORLD DISTRIBUTION

West Africa (Ghana), the Seychelles.

Sertularia ligulata Thornely, 1904
(Fig. 36)

Sertularia ligulata Thornely, 1904: 116
Sertularia ligulata Thornely: Billard 1925: 178
Sertularia ligulata Thornely, 1904: Millard 1975: 307

DESCRIPTION

Colony comprising a hydrorhiza bearing erect, monosiphonic, unbranched stems reaching 7 mm. Internodes long; nodes indistinct, slightly oblique; hinge joints occurring only to terminate the basal athecate internode; each internode bearing one distal pair of opposite hydrothecae; members of a pair contiguous in front, separate behind.

Hydrotheca with abcauline intrathecal septum; not swollen below but narrowing above; outcurved; angle of adcauline wall with stem axis 55–60°, contiguous for more than three-quarters of vertical height; free adcauline wall short. Margin delicate, more or less parallel with stem axis; two poorly developed lateral cusps, displaced slightly to the adcauline edge, and a small adcauline cusp; the cusps may be extended beyond opercular valves, especially on the adcauline side. Hydrotheca unthickened, with a small abcauline internal cusp present. Gonotheca not observed, but borne on stem below hydrotheca, barrel-shaped and with about three annulations (Thornely, 1904).

MEASUREMENTS (μm)

Internode length: 630–720. Hydrotheca: contiguous adcauline length 165–200; adnate adcauline

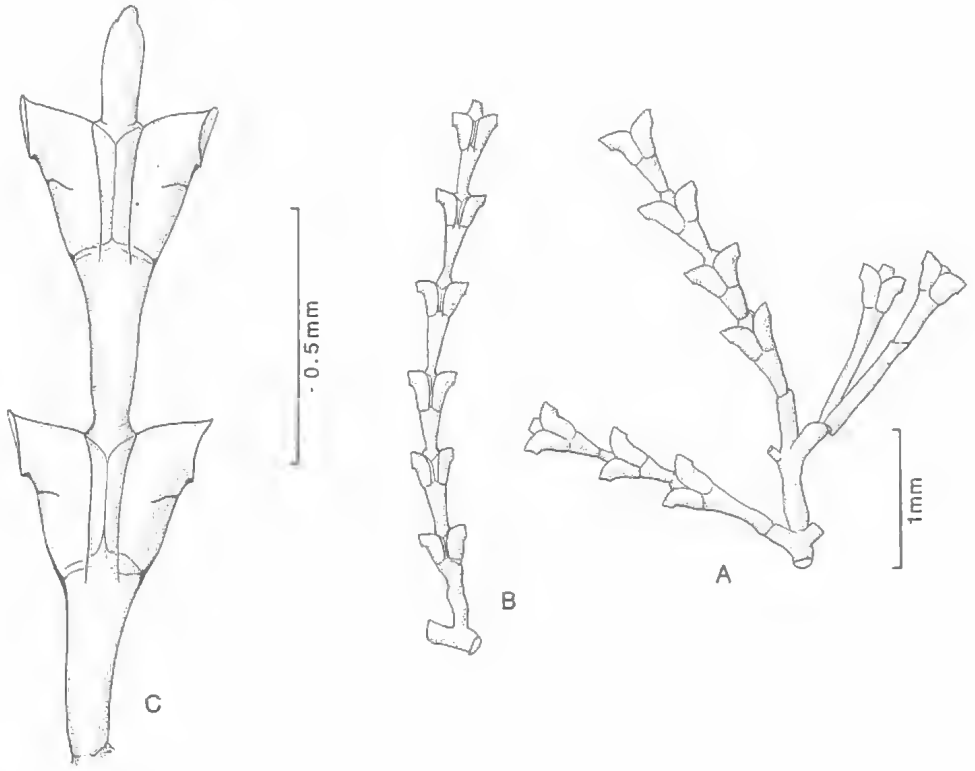


FIG. 36. *Sertularia ligulata*. A,B, stems; C, two pairs of hydrothecae. QM GL10228, Mba.

length 250–275; free adcauline length 135–155; abcauline length 190–215; marginal diameter 90–120.

VARIATIONS

The hydrothecae are symmetrical and uniform in size and shape throughout a colony. Branching was rarely observed; it may take place from one of a pair of damaged hydrothecae at the colony base, the branch having an athecate basal internode terminated by a hinge joint. Tendrils resembling hydrorhizae commonly arise from stem tips. The adcauline opercular valve is extremely difficult to observe, even by SEM, so that the species might easily be mistaken for a species of *Salacia*. However, the ligula (a leaf-shaped process on adcauline side of hydranth which projects through the mouth of the hydrotheca when extended) is diagnostic of this species, though it may be difficult to observe in contracted hydranths.

REMARKS

This material is closer to that described and illustrated by Billard (1925) and Millard and Bouillon (1973) than to that of Millard (1975) and Vervoort and Vasseur (1977). The specimens of the last authors differ in hydrothecal shape: the free adcauline wall being longer, the angle of divergence less acute, and the contiguity between hydrothecae shorter, than in our material.

OCCURRENCE IN FIJI

Under coral boulder, Yarawa reef, Mba, 8 Nov. 78 (QM GL10229); on rock and algae, Ndeumba, 18 Mar. 79 (QM GL10228); on coral rock windward Great Astrolabe reef, 25 Jul. 78, 12 Jul. 80.

WORLD DISTRIBUTION

Western and southern Africa, tropical Indo-west Pacific, Japan and French Polynesia.

Sertularia malayensis Billard, 1924
(Fig. 37)

Sertularia malayensis Billard, 1924: 649
Sertularia malayensis: Billard 1925: 173

Sertularia malayensis Billard, 1924: Vervoort and Vasseur 1977: 57
Sertularia malayensis Billard, 1925: Hirohito 1983: 49

DESCRIPTION

Colony comprising a hydrorhiza bearing erect, monosiphonic, unbranched stems, reaching 5.5 mm; nodes very oblique, resembling hinge joints; internodes long and slender, each typically bearing one proximal pair of opposite hydrothecae. Basal athecate internode long, making up as much as one-third of the total stem height.

Hydrothecae in pairs, contiguous in front but separate behind, rarely perfectly symmetrical. Each slender and tubular, without intrathecal septum, characterized by the long, thin free portion; with slight, indistinct basal swelling, narrowing a little to margin above; outcurved at 55-80°. Contiguous for more than one-half of vertical height but only one-quarter of adcauline length. Shoulder of variable prominence, more or less at point of adnate divergence, decreasing distad. Margin delicate, with two well developed, pointed, midlateral cusps.

Gonothecae borne on stem just below hydrothecae, shortly pedicellate, spherical, smooth, with wide aperture and short collar (Hirohito, 1983); not observed in our material.

MEASUREMENTS (μm)

Measurements for Fiji; Billard (1925); Hirohito (1974) *Tridentata* sp.; and Vervoort and Vasseur (1977) respectively. Hydrotheca: adnate length 90–115, 115–125, 140–170, 85–100; contiguous length 55–100, —, 120–150, —; adcauline length 105–200, 185–205, 130–210, 170–190; marginal diameter 35–50, 55–60, 50–60, 45–50; width at base 40–55, —, 50–70, —; width at flexure 150–275, —, —, —. Stem diameter: 24–43, 40–60, —, 40–45. Base-base distance: 360–545, 405–630, 420–520, 195–350.

VARIATIONS

Length of adnate portion of hydrothecae increases, and the angle of divergence decreases, distad. Many internodes have well separated proximal and distal pairs of hydrothecae; such internodes tend to be terminated by a transverse node immediately above the distal pair. Short interpolated athecate internodes common, terminated by either an oblique or a transverse node.

REMARKS

Our material agrees well with that described by Vervoort and Vasseur (1977) and, like theirs, lacks any internal cusps (compare the description by Hirohito (1974) of a superficially similar species of *Tridentata*). However, our specimens are smaller than others previously referred to *S. malayensis* (though in all characters the ranges overlap). *Sertularia gracilis* Hassall, 1848, as described and illustrated by Thornely (1904) from material collected off Ceylon (Sri Lanka) is more similar in size. *S. gracilis* is usually now referred to *S. distans* Lamouroux (Millard, 1975; Cornelius, 1979). Since the type (now destroyed but examined by Billard, 1906) was from 'Australasia' (Lamouroux, 1816), *S. distans* might be expected to occur in the Fiji area. Pennycuik (1959, pl. VI, fig. 6) illustrated long slender, but much renovated, hydrothecae in this species. The third marginal cusp that she indicated is apparently a variable character (Cornelius, 1979).

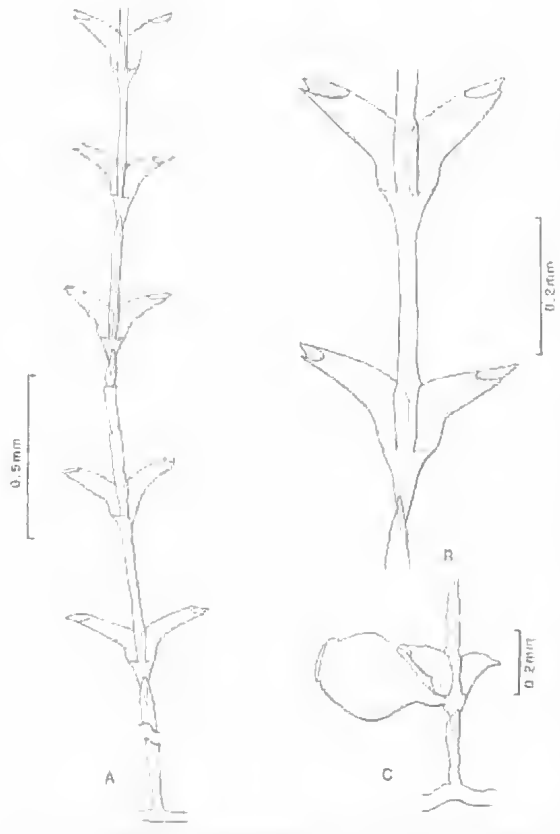


FIG. 37. *Sertularia malayensis*. A, portion of stem showing internodes; B, hydrothecae. Suva barrier reef (QM GL10230); C, gonotheca (after Hirohito, 1983).

OCCURRENCE IN FIJI

Several times under intertidal boulders, Suva barrier reef (QM GL10230).

WORLD DISTRIBUTION

Indonesia (Makassar Strait), Japan (Sagami Bay, Honshu), French Polynesia (Moorea).

Sertularia orthogonalis sp. n.
(Fig. 38)

MATERIAL EXAMINED

HOLOTYPE: Slides QM GL10231/2; BM 1988.11.12.1), Ndeumba, 20 Aug. 1978.

PARATYPES: Slides QM GL10233/4, Ndeumba, 8 Jul. 79; unmounted, Ndeumba, 9 Sep. 79 (BM 1984.5.17.26).

TYPE LOCALITY: Ndeumba fringing reef, Pacific Harbour, Viti Levu (Fig. 1, locality 12).

DERIVATION OF NAME

Gr. *orthos*, straight, right; *gonia*, angle: referring to the strikingly orthogonal arrangement of hydrothecal pairs on the erect stems.

DESCRIPTION

Colony comprising hydrorhiza with erect, monosiphonic, unbranched stems reaching 12 mm; stem nodes slightly oblique and indistinct; true hinge joints irregular in occurrence: one may terminate short basal athecate internode and others sometimes occur sporadically distally. Internode long, bearing one distal pair of opposite hydrothecae; members of a pair contiguous in front but separate behind.

Hydrothecae with abcauline intrathecal septum, slightly swollen below and narrowing to margin above; outcurved; contiguous for more than three-quarters of the vertical height, thickened on the abcauline wall. Abcauline caecum present. Angle

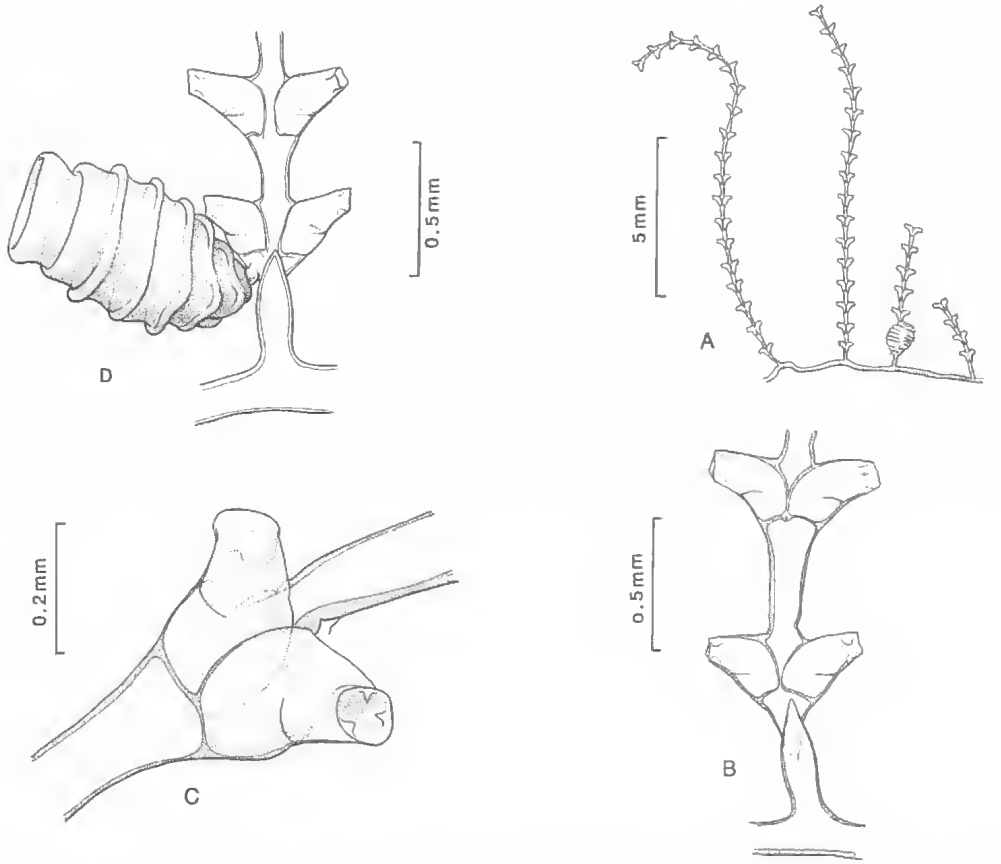


FIG. 38. *Sertularia orthogonalis* sp.n. A-C, holotype: A, part of colony; B, stem base with hinge joint; C, hydrothecae showing internal teeth; D, gonotheca (QM GL10234). Ndeumba.

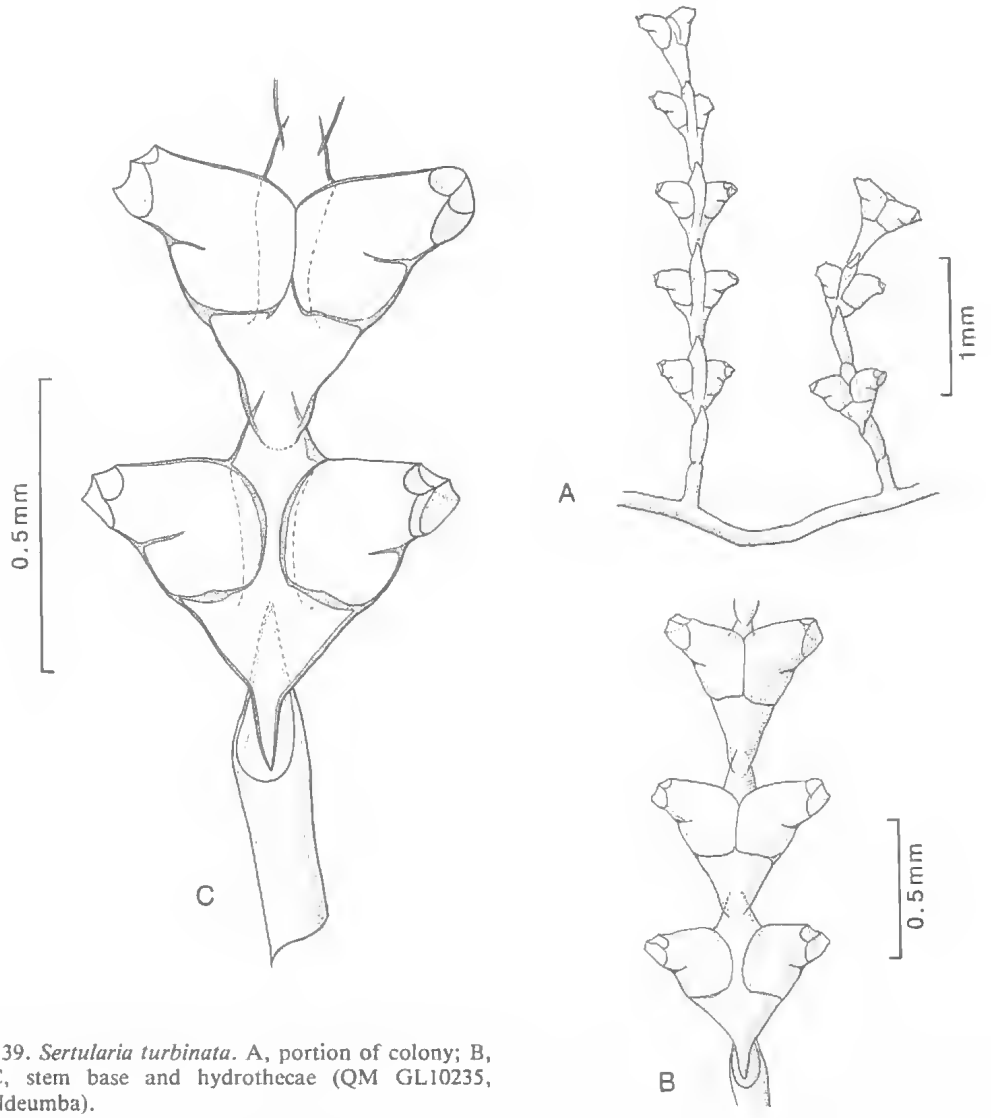


FIG. 39. *Sertularia turbinata*. A, portion of colony; B, C, stem base and hydrothecae (QM GL10235, Ndeumba).

of adcauline wall with stem axis always sharp, approximately 90°, hence margin more or less parallel with stem. Shoulder rounded at point of adnate divergence; base oblique, sloping from contiguity. Margin thickened, with three marginal cusps: two rounded laterals displaced slightly to the adcauline edge, and one small adcauline cusp; three distinct internal cusps: one abcauline and two latero-adcauline. Operculum of two valves, one large abcauline and one small adcauline; caducous.

Gonothecae borne near base of stem, below the first pair of hydrothecae. Barrel-shaped, with a broad distal aperture on a short but distinct collar; annulated.

MEASUREMENTS (μm)

Internode: width 100–125; length 700–850. Hydrotheca: adnate length 225–255; contiguous length 115–140; free adcauline length 190–225; vertical height 210–250; width from midline to outer edge 280–320; marginal diameter: 80–100. Gonotheca: length 936–1080; marginal diameter 396–594.

VARIATIONS

Basal internode usually thecate, with a transverse node immediately above hydrothecae. Hydrothecae becoming gradually more erect, adnate and contiguous distad, the angle of divergence, however, decreasing little. Branches rare:

may replace one (damaged) of a pair of hydrothecae at colony base, or arise irregularly above and/or below any hydrothecal pair; always having an athecate basal internode with terminal hinge joint; distally they resemble the stem.

REMARKS

The superficial resemblance between this species and *Sertularia tongensis* Stechow, 1919a, is striking: long internodes, orthogonal hydrothecae with parallel margins and three indistinct marginal cusps. However, Stechow observed neither an abcauline intrathecal septum nor three prominent internal cusps. Consequently, we consider our material distinct.

OCCURRENCE IN FIJI

Several records from Ndeumba, on algae, bryozoans and coral rock; reproductive 20 Aug. 78, 18 Mar. 79, 8 Jul. 79.

Sertularia turbinata (Lamouroux, 1816)
(Fig. 39)

Dynamena turbinata Lamouroux, 1816: 180
Sertularia turbinata (Lmx): Billard 1925: 177
Sertularia turbinata (Lamouroux, 1816): Millard 1975: 312
[non] *Sertularia turbinata* Vervoort and Vasseur 1977: 60

DESCRIPTION

Colony comprising a hydrorhiza bearing erect, monosiphonic, unbranched, stems reaching 6.5 mm. Nodes oblique, resembling hinge joints from behind; each internode bearing a pair of opposite hydrothecae. True hinge joints terminating the short basal athecate part of stem (which may be subdivided proximally by one or more transverse nodes), and occurring sporadically at the end of stems, terminating an extra, athecate internode. Hydrothecae of pair contiguous in front (except often at colony base) for more than half vertical height, separate behind; swollen below and outcurved above. Angle of adcauline wall with stem axis variable, 70–90°; both ab- and adcauline walls thickened; with abcauline intrathecal septum. Shoulder not prominent, often indistinct, shifted along adcauline wall from point of hydrothecal separation. Margin thickened; with a pair of well developed triangular midlateral cusps, and a small adcauline cusp; no internal cusps.

Gonotheca borne at stem base, below the first pair of hydrothecae; barrel-shaped, annulated, and with a broad distal aperture (Millard, 1975); not observed in our material.

MEASUREMENTS (μm)

Internode length: 500–650. Hydrotheca: vertical height 215–300; contiguous length 95–190; adnate adcauline length 215–240; free adcauline length 150–250; marginal diameter 105–135.

VARIATIONS

Proximal hydrothecae short and squat, angle of divergence about 90°, hence margin more or less parallel with the stem axis; members of a pair of hydrothecae usually separated in front as well a behind. Distal hydrothecae appear taller and less squat; angle of divergence less, the pair contiguous in front (often for majority of vertical height), the abcauline swelling indistinct. The material examined did not possess any internal cusps.

REMARKS

A variable species with several described forms. Our material resembles var. *acuta* (Stechow, 1921a) basally but var. *turbinata* distally.

Unlike the specimens illustrated by Vervoort and Vasseur (1977), and despite the fact that the maximum height of our material was only two-thirds of theirs, ours always possessed an abcauline intrathecal septum. This was usually complete in the basal, older hydrothecae but sometimes incomplete and patchily developed distally.

OCCURRENCE IN FIJI

Several records on *Sargassum* and red algae, LWST, Ndeumba fringing reef (BM 1984.5.17.35–37; QM GL10235/6); also on coral rock, windward Great Astrolabe reef, 12 Jul. 80.

WORLD DISTRIBUTION

Warm water cosmopolitan.

Thyroscyphus Allman, 1877
Thyroscyphus fruticosus (Esper, 1793)
(Fig. 40)

Spongia fruticosa Esper, 1793: 188
Thyroscyphus vitiensis Marktanner-Turneretscher, 1890: 210
Thyroscyphus vitiensis Marktanner-Turneretscher, 1890: Jarvis 1922: 338
Thyroscyphus vitiensis Marktanner: Billard 1907: 343
Thyroscyphus fruticosus (Esper, 1793): Millard 1975: 323
Thyroscyphus vitiensis Marktanner-Turneretscher, 1890: Splettstösser 1929: 122; Cooke 1975: 94

DESCRIPTION

Colony of erect stems arising from hydrorhiza; stem stiff, thick basally but monosiphonic; giving

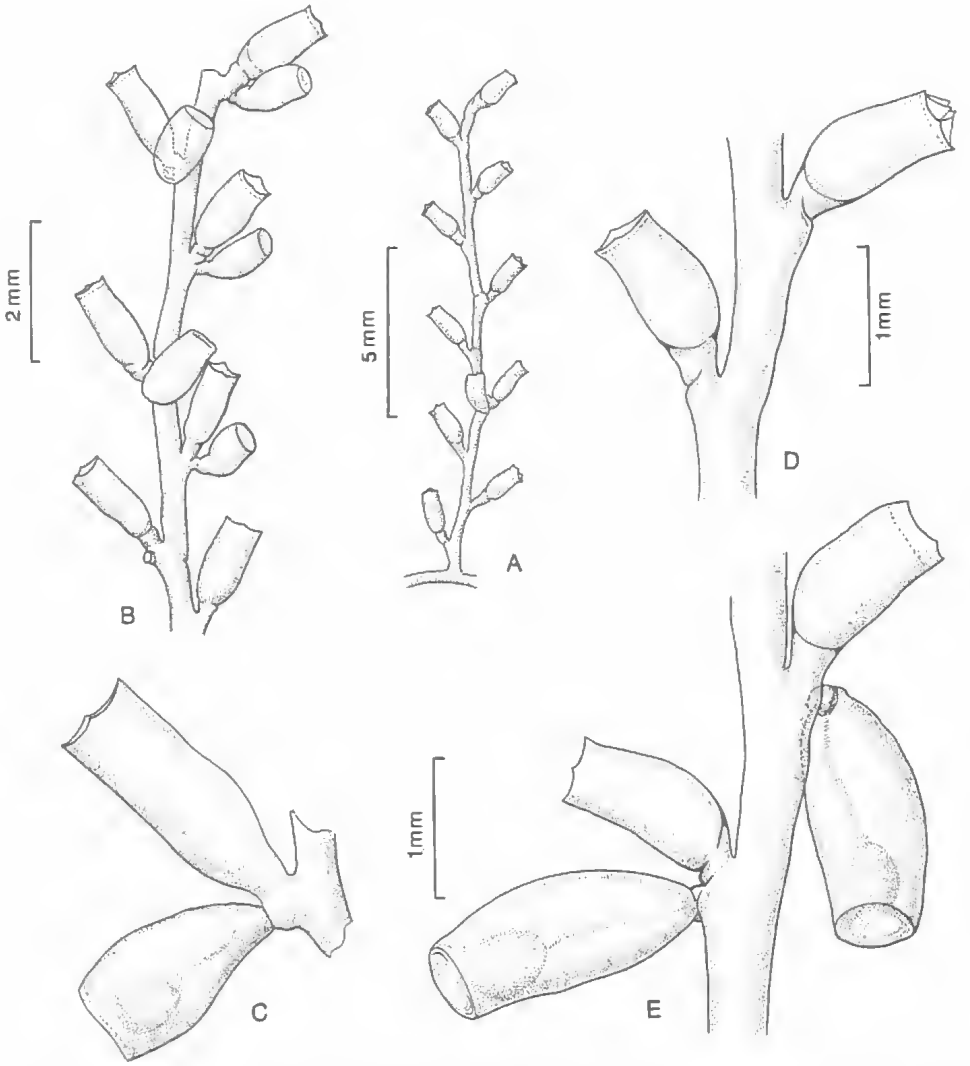


FIG. 40. *Thyroscyphus fruticosus*. A, stem; B, C, hydrothecae and female gonothecae (QM GL10238); D, detail of hydrothecae (QM GL10239) A-D, Suva Barrier Reef; E, male gonothecae (QM GL10237, Philippines).

off alternate hydrocladia in one plane; reaching 85 mm. Stem and hydrocladia bearing alternate, regularly spaced hydrothecae on short, thick, non-annulated pedicels; nodes indistinct; axillary hydrothecae always present. Pedicel borne on an anteriorly directed apophysis; node indistinct, such that apophysis and pedicel may appear continuous. Hydrotheca tubular, not expanding to margin, convex on adcauline side and more or less straight on abcauline. Margin with four low cusps; a narrow, interior ridge just below the rim at first supports four triangular opercular valves, but these are caducous and rarely present. Diaphragm an oblique perisarcal ring, better developed on the ad- than on the abcauline side.

Gonothecae borne on hydrothecal apophyses of both stem and hydrocladia. In male smooth, cylindrical, truncated distally, slightly longer than hydrothecae and directed down and outwards; wider and shorter in female.

MEASUREMENTS (μm)

Hydrotheca: length 1063–1329; marginal diameter 414–486. Stem internode: 288–720. Gonotheca (male, Philippines): length 1812–2103;

marginal diameter: 468–551. Gonotheca (female): length 1160–1257; marginal diameter 468–774.

VARIATIONS AND REMARKS

Colonies on Fiji tend to form two size groups: below 20 mm and above 40 mm. The former are usually confined to coral rock, particularly the undersides of boulders, and typically lack hydrocladia, while the latter grow from an attachment up through sand, and are well branched with long hydrocladia.

Millard (1975) described living colonies of *T. fruticosus* as being pale rose in colour, whereas Cooke (1975) has pointed out that '*T. vitiensis*' is purple. In Fiji both the tall and short colonies tend to be violet, though the short ones may be orange, especially when on the underside of rubble where the water circulation may be poor. Both become yellow on preservation.

Previous authors have merged *T. vitiensis sensu* Billard (1907) with *T. fruticosus*, for example, Billard (1933), Millard and Bouillon (1973), and Hirohito (1974). However, *T. vitiensis* Marktanner-Turneretscher, 1890, has not been included. Yet the hydrothecal structure is more or less identical and nodal development similarly variable in both nominal species. Hirohito (1974), following Splettstösser (1929), explained that the differences are based on growth form, *T. fruticosus* being monopodial and *T. vitiensis* sympodial. The small colonies around Fiji do indeed resemble the illustration by Cooke (1975, Pl. 3, fig. 1) of *T. vitiensis* and a majority of specimens show sympodial growth; but monopodial growth is evident at the tip of the stem in some. The taller colonies resemble fig. 104 of Millard's (1975) monograph and generally display monopodial growth; but they can also show signs of sympodial growth, as examination of the growing hydrocladial tips reveals. There are no significant differences between the thecal dimensions and structure of the two types and, moreover, the gonothecae (males on the tall colonies; females on the short ones) conform to those in previous descriptions of *T. fruticosus*. In our view, the material of *T. fruticosus* from around Fiji is capable of both sympodial and monopodial growth, and *T. vitiensis* Marktanner-Turneretscher (1890) should not be maintained as a separate species.

OCCURRENCE IN FIJI

In two habitats: small colonies found under boulders, large colonies growing upright through sand on outer reef flats. Particularly common intertidally in the Suva area (BM 1984.5.17.27–32; QM GL10238/39/40): Nukumbutho, Suva barrier and Joske's reef, in sand; under boulders there and at Ndeumba. Less common on the 'Coral Coast' fringing reefs. Colonies often have associated *Hebella scandens* (QM GL10191). Many samples were collected but gonothecae observed only in March and May. Also Philippines, Verde I. Strait (fertile male), 25 May 81 (QM GL10237).

WORLD DISTRIBUTION

Mediterranean and Indo-West Pacific, reaching New Zealand (Millard, 1975).

Thyroscyphus sibogae Billard, 1930
(Fig. 41)

Thyroscyphus sibogae Billard, 1930: 230
Thyroscyphus sibogae Billard, 1930: Pennycuik 1959: 198

DESCRIPTION

Colony with erect stems arising from hydrorhiza. Stems monosiphonic; typically unbranched; reaching 12 mm (usually less). Stem slightly geniculate with alternate hydrothecae; nodes indistinct, oblique; internodes regular, with distal apophysis. Apophyses of variable length, usually short, terminated by an indistinct partial or complete node. Pedicel of variable length, annulated irregularly, with one or more nodes. Hydrothecae in plane of

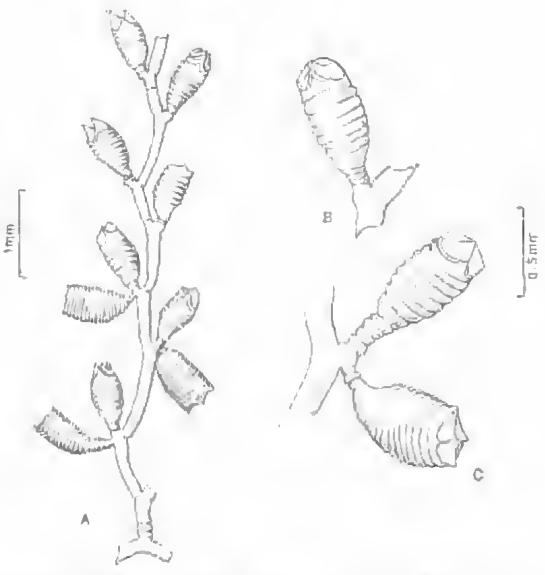


FIG. 41. *Thyroscyphus sibogae*. A, stem; B, hydrotheca; C, hydrotheca and gonotheca (QM GL10242). Suva barrier reef.

stem and directed upwards, parallel with the stem axis; ovoid to barrel-shaped, with a series of strong transverse ridges extending from the pedicel to just below the margin. As seen from certain angles, the hydrotheca may appear to have a convex adcauline side and a straight abcauline one. Margin delicate, with four smooth triangular cusps; occasionally renovated. Diaphragm an oblique perisarcal ring, most developed on the adcauline side.

Gonothecae arising from hydrothecal apophyses, pedicellate, usually directed out and down, not in the same plane as the remainder of the colony; obovoid, truncated distally; aperture with tetrad of small 'horns'. Gonotheca and pedicel annulated.

MEASUREMENTS (μm)

Hydrotheca: depth 510–770; marginal diameter 280–330; diameter at diaphragm 100–170. Internode length 450–650. Gonotheca: length 720–870; marginal diameter 330–440.

VARIATIONS

Single hydrothecae may arise from the hydrorhiza: gonothecae do not. More than one hydrotheca may be present per apophysis. Stems may branch dichotomously at base.

REMARKS

The present material resembles in every way the description and illustration of this species given by Billard (1930) and with the comments and remarks made by Pennycuik (1959). Gonothecae have not previously been described.

OCCURRENCE IN FIJI

On coral rock: Suva barrier reef (several times, reproductive 27 Apr. 79 (QM GL10242/3)); Nukumbutho reef, 11 Jun. 80; Joske's reef, 18 Sep. 78; Ndeumba fringing reef, 8 Jul. 78 (BM 1984.5.17.33)

WORLD DISTRIBUTION

Indonesia (Timor) and Great Barrier Reef (Low Is).

ACKNOWLEDGEMENTS

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